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NORTH AMERICAN DESERTS.

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One of the most important purposes of the Desert Laboratory, which constitutes the centre of effort of the Department which I have the honour to represent, is the investigation of the water and light relations of plants in their widest aspects. The prosecution of the researches upon the main problems which have presented themselves directly has incidentally led us into fields common to nearly all of the sciences. In fact, progress in modern botanical science is much like building cantilever viaducts, the farther ends of which may come down upon foundations in chemistry, physics, geology or geography. The point of view acquired in such experiences leads one to expect similar expansion in related subjects, and particularly the botanist hopes to meet the geographer in a common interest in the forces which act in a causal or modifying manner on the surface of the globe.

It is conceivable that views might be held which would limit geography to exploration and cartography, and botany to descriptive work and laboratory experimentation, but such restriction would cause both sciences to fall far short of their possible usefulness. The geographer holding to the narrower interpretation of his subject might ignore the existence of vegetation, and decline to take into account all organic agencies; but the botanist may no longer content himself within a similarly limited choice. His problems lead him to consider a wide range of facts and phenomena which interlock with the external activities of plants, and knowing a little of the midways of science he can no longer ignore their possibilities. The botanist must perforce be something of a geologist; the intensity of the meteoric factors are of prime importance in his interpretations, and a large

* Royal Geographical Society, December 18, 1911. Map, p. 192.

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share of his conclusions are unintelligible except from the geographical point of view. It is in this broad domain of conjunctive science that the activities of the members of the Desert Laboratory chiefly lie, and the presentation of some of the features of the desert as viewed by those co-operating in our work is the main purpose of the present paper.

The need of a consideration of the subject from widely separated points of view is emphasized by the fact that although one-sixth of the total land surface of the globe is desert, yet when an attempt is made to ascertain upon what grounds the classification is made, considerable vagueness is met with. It is to be acknowledged at the outset that we are not ready to construct the equation of the desert at the present time. The topographical, climatic, geological, and biological features which are so obvious in any arid region, are yet not easily reducible to exact expression. The boundaries and limits of desert areas are likewise not readily definable, and it is only in a very few localities that the traveller may pass directly from the desert to naturally moist and fertile lands innocent of all phenomena of aridity. It is quite feasible, however, to point to the position of the more pronouncedly desert regions, to recognize the things which ameliorate them gradually or abruptly to moist conditions at their margins, and to cite the distinguishing characteristics of desert regions in general (see map).*

The primary condition of aridity is obviously that of a restricted precipitation, but plain as this may be, no limitation of amount may be fixed upon, which would result in the formation of a desert. Latitude and altitude, of course, modify the effect of a given amount of rainfall on any land area, but it would be quite impossible to say, for instance, what rainfall would be followed by a desert in latitude 18° or 34° N., or at elevations of 2000 or 8000 feet in any latitude; since the topographical relations and wind-flow are equally important features which are difficult to correlate. Two aspects of the water-relation are easily appreciable, however. These are the ratio of the annual precipitation to the possible evaporation and the ratio of the maximum and minimum annual precipitation.

Assuming that the possible evaporation from a free water surface in the great desert basins of Utah would be about fifty inches yearly, this amount would be nearly five times the maximum rainfall, ten times the minimum, and six times the average, although greater disproportions undoubtedly are to be found in this region. The evaporation in the Salton basin is about seventy-two inches yearly, which is a hundred and twenty times the minimum rainfall and twelve times that of the heaviest precipitation known. No accurate data from the eastern moist temperate portion of the continent are available, but the supposition is hazarded that the fertile region between the Mississippi and the Atlantic receives an amount of rainfall not far

* MacDougal, 'Botanical Features of North American Deserts.' Publ. Carnegie Inst. of Wash., No. 99, 1908.

from the possible evaporation. The biologist does not go very far into the study of the environment of plants and animals before he is brought to realize that meteorological records, especially of temperatures, as now made in the observatories of the world are not kept in such manner as to include some features of prime interest in agriculture. Maximum and minimum temperatures are highly variable in their limiting value, and averages of temperature are all but meaningless in cultural operations. It has been proposed, therefore, to integrate temperature, wind-flow, relative humidity and intensity of solar radiation in terms of evaporation from a water surface, and the invention of the porous clay cup atometer by Professor B. E. Livingston, has given us a very efficient tool for the measurement of evaporation as a factor affecting vegetation. Doctors Livingston and Shreve, by the aid of a large number of collaborators at stations widely placed over the continent, have secured data demonstrating that the relative rate of evaporation during the growing season applied to the rainfall gives results upon which the character of the dominant vegetation may be determined with fair accuracy. A map of the continent is now being compiled in which the concurrence of atmometric data and the existence of deciduous forest, grasslands, coniferous forest, cactus regions, etc., are to be illustrated.*

The second important feature of the water supply is that of the ratio of the maximum and minimum annual rainfall, first proposed as a factor in climate by Angot in 1883. A disproportion between the annual amount received, as great as one to three, has been found by Dr. Shreve in the mountains of Jamaica, and doubtless occurs in some few tropical and moist regions, yet this is a pronounced and invariable feature in deserts. It is in effect a yearly irregularity, the geological and biological effects of which are much too complicated to be discussed within the limits of the present paper. A review of the conditions in North American deserts with regard to this point reveals the fact of the great diversity to which arid areas may be subject. For example, the great sage brush regions of Utah and Nevada, formerly known as the Great American Desert, and one of the most difficult to traverse, has a maximum which is more than two and a half times as great as the minimum, and the desert character of the region is such as to make it deserve its reputation for intensity. The wide valleys and slopes of the Sonoran desert, in which the Desert Laboratory is situated, receive a rainfall which may vary from 5 to nearly 24 inches yearly, while 500 miles to the eastward across the main continental divide, in the Chihuahuan desert, the ratio may be as one to nine. The extreme conditions are to be found in the Mojave basin, in which the total precipitation may be ten times as much in one year as in another, while in the rainfall

* B. E. Livingston, 'The Relation of Desert Plants to Soil-moisture and Evaporation.' Publ. Carnegie Inst. Wash., No. 50, 1906. "Relation of Soil Moisture to Desert Vegetation," *Bot. Gaz.*, vol. 1, pp. 241–256; 1910. "A Study of the Relation between Summer Evaporation Intensity and Centers of Plant Distribution in the United States," *Plant World*, vol. 14, Oct., 1911.

in the Salton basin the disproportion is nearly as great. It is well known that the rainfall in all such sheltered basins is irregularly distributed throughout the year, and that these places are subject to highly localized storms or cloud bursts, in which a yearly total is sometimes received within the space of a few minutes. Neither the rainfall-evaporation ratio, nor the maximum-minimum ratio, alone, may be taken as a causal condition to deserts, but their concurrent existence is invariably accompanied by the phenomena of aridity as denoted by the character of the erosion and the types of the dominant vegetation. It seems probable that the development of a plan proposed by Dr. Shreve by which soil-moisture and evaporation ratios applied to the length of the dry season may furnish rational expression of the arid character of a region.

An extension of the study of the effects of the total rainfall and of variations of rainfall and evaporation leads one to a consideration of the actual amount of water necessary for the development of vegetation. Rapidly growing crop plants are said to take up and use from 300 lbs. to 600 lbs. of water to produce one of dry material.* Probably as much as a ton of water must be put on a given area to produce a pound of dry plant substance, since only a fraction of the total falling on the soil may be taken by the plant. This proportion would hold only for closely grown crops. The mode of life of the various types of desert vegetation which will be discussed later is such that it might be safely estimated that 10,000 to 25,000 lbs. of water would need be received by the soil in order to allow the formation of a pound of dry matter by the small, quickly growing annuals, massive succulents and slowly growing spinose perennials of arid regions.

Aside from the climatic effects described, the western American deserts are, of course, subject to the general alternation of the seasons, and two distinct types of climate are encountered. The regions which lie seaward of the higher ranges near the Pacific coast receive only the westerly storms, and have but a single period of precipitation, culminating in intensity in January and February, with a rainless period extending practically from March to November. The immense area between the coastal ridges and the main continental divide, and to the eastward of it, is also subject to midsummer storms of tropical violence, which result from the heating of the great land mass. It thus follows that some of our deserts have one period of precipitation annually, others lying in sheltered positions have their rainfall irregularly distributed throughout the year, and others have two well defined periods of precipitation. It is needless to say that the general appearance of the surface, and of the vegetal covering, differs widely in these regions (see diagram on map).

The deserts of North America include as a prominent feature a number of great basins, the rims of which rise high above the level of the

* McGee, "Prospective Population of the United States," *Science*, vol. **34**, p. 428. 1911.

lowermost portions, such as the depressions once occupied by Lakes Bonneville and Lahontan, in Utah and Nevada, the Mojave basin, Death valley, and the Salton basin in California, the Otero basin, in New Mexico, and the shallower Bolson of Mapimi, in Chihuahua. The precipitation in these basins, together with the run-off from the rocky slopes of the mesas and mountains, drains toward the centre, and may, in some instances, reach the lowermost depression in such quantity as to form a permanent lake—as the Great Salt Lake of Utah—with a widely fluctuating level. In other cases, the drainage may reach the low places in the basin only in times of flood; and the bodies of water formed at this time soon evaporate, giving rise to many so-called "dry lakes," of which a notable example is found in eastern Arizona, being crossed by the main line of the Southern Pacific Railway. This lake-bed lies in a region in which very perfect mirages are encountered, and the traveller, viewing it from a distance, may not say with certainty whether the lake-bed is wet or dry until his train actually runs out on the rails that cross it on an embankment raised only slightly above the general level.

The surface features of the great basins of Utah and Nevada are so well known from the writings of Gilbert and Russell, that it would be superfluous to go into any detailed description of them.* Both basins lie at some elevation in a latitude which brings low minimum temperatures. The yearly irregularity of the rainfall is as one to two and a half; the possible evaporation may be estimated as six or seven times the average precipitation. The lowermost portions are occupied by sinks, saline plains, or permanent lakes, the Great Salt Lake being the fluctuating remnant of the ancient Lake Bonneville.

Thousands of square miles of the slopes support a dense growth of *Artemisia*, and consequently the region is known as the "sagebrush plains," while a stretch 50 by 120 miles southward and westward of the Great Salt lake still receives the appellation of the Great American desert. The maps of half a century ago spread this term to include not only all of the basins, but also the "short grass plains" to the eastward of the main continental divide.

Deserts were formerly characterized more strictly with regard to their influence on human activity. A region which did not furnish the traveller with fuel, forage, water and shelter was apt to be regarded as "uninhabitable." "Absolutely devoid of vegetation" is still a ready phrase among explorers, although some of the areas to which this description has been applied may show hundreds of low-growing perennials per acre, as is well known with regard to certain portions of the Sahara.

"Dry farming," in which the rainfall, amounting to 12 to 20 inches annually, of one or two seasons is conserved by special tillage and made

* I. C. Russell, "Geological History of Lake Lahontain," 'Misc. Doc. House of Rep., 1st Session, 49th Congress,' vol. 2, 1885–1886. G. R. Gilbert, "Lake Boureville," 'Misc. Doc. House of Rep., 1st Session, 51st Congress,' 1889–1890.

to grow a crop every second or third year, has been practised with success in the great basins mentioned, but it may be predicted with fair certainty that this method of agriculture will not be found profitable under present economic conditions in regions in which the yearly irregularity of precipitation is greater than one to three, and the evaporation does not amount to more than five or six times the average rainfall. The possibilities of irrigation, as yet but little developed, and the other industries of the region marked as desert on the accompanying map combine, however, to give it the greatest wealth per capita of any part of the country.*

The best method of gaining a comprehension of the mechanism of the desert is by the consideration of the phenomena offered by smaller areas, and it is proposed therefore to discuss some of the features of the Salton basin of the desert of the Colorado, as this region has been the subject of considerable study during the last few years. This basin lies north-eastward of the San Jacinto mountains, and as this range reaches an altitude of about 10,000 feet, the basin is sheltered from the westerly winds, the only rainfall reaching it being principally that of fringes of the "sonoras" or mountain storms which usually come in such manner as to be regarded as cloudbursts. The yearly precipitation at any one station may, in consequence, vary in the ratio of 1 to 9 or 10, the actual minimum being as low as six-tenths of an inch, while the annual maximum of less than 6 inches may be received in less than a day. The open part of the basin has an area of about 5000 square miles, but the foothills of the limiting ranges and the drainage area back to the mountain summits raises the total to more than twice this amount. Various uncertified maximum records of temperature of 118° to 128° F., are known from the region, although our own instruments have not gone above 109° F. The possible evaporation has been estimated by the United States Weather Bureau 69 to 72 inches yearly, which is nearly thirty times the average precipitation, and a hundred and twenty times the minimum. It is to be seen, therefore, that we are dealing with a region of extreme aridity, and the instrumental results are fully borne out by one's personal impressions in the field. Furthermore, the presence of some desert deposits not later than the Tertiary shows that the place was arid at a time extremely remote. We are not prepared to say, however, that it has been dry continuously or uniformly. The lowermost part of the basin lies 284 feet below sea-level, and 40 feet above sea-level is a well-marked beach-line. Below this high beach-line and within 253 feet of it are to be seen eighty-three different strands, denoting stages in the level of the ancient lake, which at various times contributed to a deposit of travertine many inches thick on the rocks bathed by it at its upper levels. It has been customary to consider the lower part of the basin as having been once occupied by an arm of the Gulf of California, but many difficulties stand in the way of acceptance of this simple solution of the problem. The delta at the present time closes

* Widtsoe, 'Dry Farming.' New York: The Macmillan Co. 1911.

the southern end of the basin so incompletely that the full lake would communicate with the Gulf by a possible flow 20 feet deep, and the height of the lake is 40 feet above the high tide levels of the Gulf itself. Furthermore, the saline deposits occurring in the basin are of lacustrine rather than marine origin, as shown principally by their composition. It would be unsafe to assume a narrow limit of conditions under which travertine might be deposited, but it is highly suggestive that the old incrustation is heaviest immediately below the highest water level, and that the lake at the present time with a concentration only slightly more than seven-tenths of 1 per cent. has begun to unload its calcium content. It seems impossible to account for the basin without recourse to some assumptions as to upheavals, but this is a question of a purely geological character. The alluvial deposits of the delta form part of the great bowl of the Salton, and not infrequently within historic times floodwaters have found their way in great quantity across the rim and down into the basin, making a lake of small size. A few years ago a large canal was cut out from the banks of the main river channel leading water over the edge and down the slopes of the basin irrigating an area which became known as the Imperial valley. Floodwaters enlarged this canal in 1905, 1906, and 1907, in the absence of proper headworks, and the water was brought under control only after tremendous effort and at great cost. Meanwhile sufficient water has escaped into the basin to form a lake 50 miles long, 25 miles at its greatest width, and 84 feet deep in places, which probably simulated in every feature previous makings of the lake in the desert.*

The political situation is one worthy of some attention. The Mexican-American boundary crosses the delta at right angles, and part of the basin lies in the province of Baja California. The irrigation canal was planned to take water out of the Colorado river, the navigable channel of which forms a north and south section of the international boundary, and, after making a loop through the delta in Mexican territory, crosses the line to irrigate farms in California. It was necessary to extend a railroad and take an army of workmen into Mexico to bring the flood waters under control in 1906, and all operations were put in charge of the managing engineers, practically making American territory of a large area for the time being. Extensive protective operations have been continued by our engineers far down the river, and it speaks volumes for the diplomatic relations of the two countries concerned to say that no territorial questions have been allowed to interfere with engineering plans. During many months of the present year the Mexican federal government lost entire control of the region, but the insurgent army, using the canals as defensive works, did nothing to interfere with the delivery of an adequate supply of water on the American side.

The Salton basin had been an object of interest in many ways to various

* MacDougal, "The Desert Basins of the Colorado Delta," *Bull. Amer. Geog. Society*, December, 1907.

members of the staff for many years, and the writer made a visit to its lowermost part in 1902, and was so fortunate as to secure photographs of the surface and the vegetation. The making of the lake during 1906 found the Desert Laboratory fully organized, and plans for research in various problems were made at once. The opportunity secured was unparalleled for the study of the unmaking and remaking of the desert, with all its attendant phenomena of sterilization and revegetation of the area occupied by the lake. A first visit of observation was made in May, 1906, when the lake had not attained half its depth, and the Colorado still flowed into it at a rate which brought its depth from 34 feet to 84 feet by the following February. Meanwhile a small expedition had been planned, and we started from the north-western end of the lake in a sail boat on February 7, 1907, being so fortunate as to be afloat on February 10, the day of maximum level. The total area now amounted to about 450 square miles, the water was as yet unsettled, and bore on its surface all of the drift of a river in flood as well as thousands of water-worn and rounded fragments of pumice which had been lifted and shifted in previous inundations of the basin. The long tongues of water extended up the channels of the dry washes, and the loosely-packed wind-borne soil of the desert when wetted became a strip of mud below and above the actual water-line that made landings difficult. The water at this time contained about one-fourth of 1 per cent. of dissolved salts, and was consequently drinkable, and, as was seen by results obtained later, was not especially harmful to seeds of many kinds.

A group of mud-volcanoes was covered by the lake and the surface of the water has since showed no indications of their activity. Many small hills stood in the lowermost parts of the basin, and some were completely submerged, while three rose many feet above the water-level. The results which have been obtained from the observations on the island of Krakatau since its denudation by volcanic action, inspired us to watch the behaviour of these islands with the keenest expectancy. The highly alkaline soil of the Salton hills was first sterilized by the brackish water, which gradually became salter, then, later, the hills began to emerge as islands separated from the shore by miles of water. One might with but little exercise of the imagination, see in them the making and peopling of new lands, with fair hope of detecting the relative action of the various agencies which would be operative in bringing seeds or spores to them.

Our observations on the emersed islands are rich in detail of main interest to the botanist, but the more general facts may be pertinent here. It soon became evident that flotation was the chief way in which plants might win their way to unoccupied lands of this kind, and only one introduced species was found above the high-water mark. The fruit of this species being an adhesive burr, support is given to the supposition that it may have been brought by birds, which resort to the islands in great numbers. No evidence of seeds wind-borne to the islands was found,

PLATE I.—TOP OF A HILL ONCE SUBMERGED APPEARING AS AN ISLAND IN THE SALTON SEA. THE FIRST PLANTS FINDING A FOOTHOLD ARE *PLUCHEA* AND *ALLENROLFEA*.

PLATE II.—DRY BED OF MIDDLE LAKE, OTERO BASIN, NEW MEXICO.

although many must have been brought to the lake in this manner and then cast ashore by the water (Plate I.).*

Popular opinion ascribed climatic effects hundreds of miles away on the desert to the lake, but, as a matter of observable fact, the visible effect of the presence of this body of water on the surrounding slopes of the basin was very small. This was not unexpected, as arid conditions may be recognized by the character of the vegetation within a few feet of mangrove strands along the Gulf of California. The only noticeable changes above the highest level of the lake were those attributable to the damming of the underflow from the steeper slopes of the mountains on the southwestern side of the lake. It is on these steeper slopes also that the receding lake is leaving some terracing effects with sorting of the material in the strands. The separation of the coarser and finer material of a strand makes bands or lines of substratum suitable for certain plants, and the lack of erosion by wind and run-off in sheltered localities leaves such places undisturbed with the result that beach lines which one would hardly dare date within four hundred years are accurately marked by rows and bands of vegetation. The establishment of such vegetational lines has already been seen and, in a few places, with a gentle gradient, the emersed strands of 1907 have already returned more or less completely to the desert conditions prevailing previous to the recent flood. The total evaporation from the lake amounts to about 70 to 72 inches yearly, of which about 18 to 20 inches are compensated for by the underflow and run-off from the mountains, by the water from a few artesian wells, and by the waste from the great irrigation system from the canal which formerly fed the lake. Our present studies may, therefore, be continued until this inflow meets the evaporation loss, which would occur under present conditions with a lake surface of about 150 square miles.

A second region which has received some detailed attention is the Otero basin, which lies east of the main continental divide in New Mexico, in a region in which the yearly irregularity of the rainfall is as one to nine,† and the average about one-sixth or one-seventh of the possible evaporation. This basin is a long narrow dropped block between two mountain ranges. The detrital slopes fall steeply at the foot of the mountains to a flat and featureless plain, in which lie several *playas*, the whole valley being deeply filled with material worn from the mountains. The basin seems to have been occupied by a variable lake, which, after its last period of expansion, deposited beds of reddish, gypsiferous and saline clays. The intermittent rainfall and the action of the wind have resulted in covering these deposits to some depth. The *playas* of which there are five or six a few miles across become shallow lakes, which, in dry periods, are beds of gypsum and salt

* See 'Reports of Department of Botanical Research,' Carnegie Inst. of Wash., 1906, 1907, 1908, 1909, 1910, and 1911.

† MacDougal, 'Botanical Features of North American Deserts.' Publ. Carnegie Inst. of Wash., No. 99, 1908.

(Plate II.). Nowhere may more beautiful wind effects be seen, and the dry beds as well as the older deposits are subject to its erosive effects in such manner that a great series of gypsum dunes cover an area of about 15 by 40 miles (Plate III.). Still older dunes, fixed and covered with vegetation, give evidence of a period of slightly greater rainfall not farther back than a few hundred years, and the terraces and old lake strands promise some interesting evidence upon a subject to which Prof. Ellsworth Huntington in co-operation with the Desert Laboratory, is devoting much attention. The biologist looks into the life of these basins with the keenest interest as to the occurrence and distribution of the existing species. No species endemic or characteristic of either the Salton or Otero basin are found so far as available information goes, although such forms are known in the greater basins of the Death Valley and Mohave Desert. Plants of extremely localized distribution are numerous in a large part of the general region in which these basins lie. Alterations in climate would of course affect these enclosed basins most profoundly, and if new forms have originated in them they may be taken to have disseminated beyond the limits of their birthplace, with the result that their genetic connection with a locality is lost to us.

Many other large self-centred drainage areas are included in American deserts, but this brief description will serve to characterize the more important basins. The greater part of the desert, however, consists of elongated trough-like valleys, tributary to the larger rivers like the Colorado, and receiving the run-off from the mountain slopes. The mountain streams may barely emerge from the mouths of the cañons in which they are formed, or they may make their way down the slopes according to the season, the volume of water carried and the steepness of the slopes. The Santa Cruz river gathers the drainage of a dozen mountain ranges, and fills a well-defined channel near the Desert Laboratory in times of flood. A few miles away it spreads over a *playa*, miles in width, from which water has been spilled over into the Gila river but few times in the memory of living men (Plate IV.). It has been my good fortune to be in camp near the termination of the flow of a desert stream making its way down the dry channel, and I found it extremely fascinating to watch the tip of the tongue of moisture as it advanced by night and retreated by day over a distance as great as a hundred yards. Many incidents are on record of travellers camped in the dry channels of such streams being overwhelmed by walls of flood sweeping down on them from the distant mountains.

The water which sinks into the coarse sponge of the detrital matter may strike clayey layers lower down, and be forced to the surface, where a short course is run until the water evaporates or escapes over the edge of the impermeable layers to be lost again in the gravels. Such is the history of various "lost rivers," and the pools, which may be seen in clayey formations or harder rocks, are known in the south-west as "tanks" (Plate V.).

PLATE III.—GYPSUM DUNES FORMED FROM THE DEPOSIT IN LAKE-BED, OTERO BASIN, NEW MEXICO.

PLATE IV.—VIEW FROM DESERT LABORATORY. THE SANTA CRUZ RIVER IS IN THE MIDDLE DISTANCE. THE DETRITAL SLOPES MAY BE SEEN AT THE FOOT OF THE SANTA CATALINA MOUNTAINS IN THE DISTANCE.

The aboriginals of this region also had the practice of making bowl-like depressions in the soil, which were tamped with clay, and thus acted as reservoirs, which are designated as "charcos." One of the earliest things to receive attention in any desert valley is that of sinking bores to test for the presence of water, and these holes must sometimes go down to as much as 400 or 500 feet before a water-bearing stratum is found.

The habits and adaptations of the aboriginals and other animals with reference to arid conditions are of surpassing interest. Large mammals and birds are known which go for months without any water beyond that obtained by eating succulent cacti. Deer and peccary have been found in regions in which the nearest accessible water was 30 or 40 miles distant. Some of the smaller rodents are known to be able to live on hard grains alone, which may contain not more than 10 or 15 per cent. of water.

Man and the horse are among the animals least adapted to undergo the inevitable thirsts of the desert. The traveller afoot may consume and need as much as 16 pints of water daily, and entire deprivation of water for a period of more than 24 hours is likely to be followed by the most serious consequences. The use of such great quantities of the liquid gives special effect to dissolved salts, and the frequenter of the desert may not use for any length of time water containing more than one-fourth of one per cent. of saline material, although he is frequently compelled to make shift with stronger solutions for brief periods. The horse may endure more concentrated solutions, but its needs are truly enormous, as 15 to 30 gallons per day is the average requirement. The smaller half-wild horses of the south-west may make long traverses, and go for a second or third day without drinking, but their endurance is far surpassed by that of the Mexican donkey or burro. A serious effort was made to introduce the camel into American deserts about half a century ago, coincidently with its being taken into Australia, where it has proved so useful. The attempt was an unnecessary failure. The development of the modern motor has now made the camel unnecessary, as the horse and the donkey may be used to supplement the automobile for all the necessities of travel at the present time.

Mountains which rise to altitudes of 7000 and 8000 feet will, of course, receive a rainfall far in excess of low-lying slopes and valleys. The average rainfall at the Desert Laboratory is about 12 inches yearly, but the slopes of the Santa Catalinas, which rise over 6000 feet higher (to 9025 feet) have an annual precipitation three times as great. This supply of water makes a climate far from arid, and supports a vegetation in which mesophytic types are very abundant. The general aspect of the entire desert would therefore be that of a great region (including many rivers of size) moist on the upper portions of the mountain ranges, with the rainfall collected in streams which flow down to the arid lowlands carrying a fringe of moist soil, in some instances clear to the sea. The accompanying map, compiled by Dr. Forrest Shreve, gives the position and extent of

the arid region of North America, in which only the principal mountain ranges are indicated, and no attempt has been made to accomplish the difficult feat of tracing the non-desert strips along the river courses, or to marking the mountain ranges which attain a height of less than 7500 feet (see map). Above this the surfaces may be carpeted with vegetation, and a layer of soil of some depth may be retained. Below this, in south-western America, the arid character of the mountain slopes is unmistakable. The habit of most desert plants is such that they stand isolated from each other, and the loose material on the unprotected slopes is moved by the wind and swept down by the occasional precipitation to the base of the mountain. Nothing is so surely indicative of aridity as the disposition of the detrital material at the base of the slopes from which it came, and nothing so clearly expresses the abruptness with which the exposed base of a mountain wall rises from the loose material at its foot as to say that one may walk over the lower slope and lean against the mountain as against a wall. The character of the long arched slopes in which the detrital material from desert mountains is disposed by the torrential action of the streams coming from them is equally distinct. Our Mexican neighbours have long designated such slopes " bajadas," and, in accordance with the proposal of Prof. C. H. Tolman,* this term is used exclusively by the workers at the Desert Laboratory. Boulders and finer material are mingled indiscriminately in *bajadas*, but the finer material in suspension is carried until the water of the outflow comes to rest in the level places in the middle of the valleys, where the deposit of this finer material forms level flats or *playas*. The terms *bolson*, *playa*, *mesa* and *bajada* are in common use by the inhabitants of Mexico, and it is found to be a great convenience to be able to apply these common appellations in an exact and discriminating manner, particularly in the field with Mexican helpers (Plate VI.).

The vegetation of deserts presents specializations quite as marked and characteristic as the phases of erosion, evaporation and precipitation, and no adequate discussion of an arid region is possible without some presentation of the more salient biological features. It has already been pointed out that the mountain-tops within even the most arid regions are moist, and the streams flowing down from them furnish habitats for plants requiring much moisture, and presenting an aspect not much different from that of other broad-leaved forms in the temperate zone. In addition to these biological islands, the flora of many arid regions includes a large number of rapidly maturing annuals, which complete their development during the rainy season, and pass the rainless periods in the form of seeds. These, likewise, are not distinguishable from species of moister regions, so that altogether Prof. Spalding found that over forty per cent. of the total plant population of the area about the Desert

* C. H. Tolman, *Jour. of Geol.*, vol. **18**, Feb. and March, 1909.

PLATE V.—A "TANK" IN THE DESERT.

PLATE VI.—A "WASH" OR DRY STREAMWAY IN AN ARIZONA.

Laboratory consisted of non-desert forms, and if the species from the mountain tops were included, the proportion would be even greater.* The results of such an analysis would seem to be of special significance to the palæontologist in the deduction of climatic conditions from fossil remains. The mechanical relations of this mesophytic element of the flora to the streamways are much more favourable for their preservation than that of the characteristic desert plants, as they would be especially liable to be covered up in *bajadas* and *playas*.

The observer may get his most correct impression of the habits and character of a desert flora by gaining the top of a small prominence from which a view may be had of near-by mountain-slopes and of the *bajadas*, which fall gently away from their bases. It is seen at once that the separate individuals do not crowd each other, making dense cultures, but that nearly every shrub and bush stands alone out. The separation of the individual plants is connected with the fact that the roots instead of being deeply penetrating are horizontally disposed very near the surface, and that the superficial layer of the soil is densely occupied for a depth of 6 or 8 inches only. Root-systems of this character are in a position to absorb water most advantageously after the rains, which do not penetrate deeply, but the sparse shoots offer but little shade which would lessen evaporation. The surface dries quickly after a rain, and is subject to wind erosion at all times, and, of course, the amount of humus present is very slight, some being found around the bases of low-growing shrubs.

Two distinct types of desert plants or *xerophytes* may be recognized: one includes the forms with reduced woody stems and branches, restricted leaves and water-proofed surfaces being in general of a spinose character. These structures are correlated with some very striking qualities. The juices of the leaves and stems of some spinose species that have been examined show a concentration which would give them an osmotic pressure of 75 to over 100 atmospheres. The roots are in constant absorbent contact with the soil, and presumably a slow diffusion of soil solutions into the plants goes on almost constantly since they quickly perish when removed from the soil, and are difficult to transplant (Plate VII.). The second type of xerophyte is a succulent which accumulates a large water-balance, the cacti being excellent illustrations. All of the reductions of the spinose plant are exhibited by these forms in an accentuated manner, and some of them show such extreme specialization that the entire shoot consists of a single thickened trunk, leaves and branches having been lost. Succulents are specially abundant in regions with the precipitation occurring within well-defined periods. The widely extended root-systems form new roots quickly under the stimulus of heightened soil moisture and temperature. Large quantities of water pass into the roots and into the thickened

* V. M. Spalding, 'Distribution and Movements of Desert Plants.' Publ. Carnegie Inst. of Wash., No. 113, 1909.

stems and other organs during the time in the rainy season in which the soil moisture is above ten per cent. The drying of the soil below this limit following the cessation of the rains, however, soon results in the death of the absorbing rootlets, and the plant then lies simply anchored in the soil by the larger roots. It is of interest to note that the juices of these plants contain so little dissolved material that their osmotic pressure is usually not over 10 atmospheres. Plants of this kind may exist for extended periods upon the large water-balance which they have accumulated (Plate VIII.). The saline and alkaline areas of deserts are characterized by still a third type of vegetation, the fleshy beach plants or salt marsh plants, which are mostly cosmopolitan, and have no direct connection with arid conditions.*

Questions as to variations in climate have received much attention in the last few years, and evidence from the most diverse sources has been examined with regard to its bearing upon the matter. Prof. Ellsworth Huntington has been especially active in this research, and has been carrying on field work in connection with the Desert Laboratory during the last two years for the purpose of comparing piedmont gravel deposits, lacustrine and fluvial terraces, ancient ruins, and traces of agriculture, tree structure, and plant remains in the American deserts with the results of similar observations in Asia. The remarkable apparent concurrences of climatic phenomena in widely separated regions brought out by this work seem worthy of the most serious consideration. An analysis of the surface geology of the region about the Desert Laboratory indicates that some fluctuations in the climatic factors have taken place in that region.† The effect of such changes is a topic worth a few minutes' consideration, and, for the sake of a clear understanding, it might be profitable to follow in imagination the consequences of the desiccation of a well-watered region, and to make a theoretical outline of the probable happenings when the climatic swing was reversed and a period of humidity followed one of aridity.

Chief interest centres, of course, in the amount of rainfall, and in the ratios described in the preceding part of this paper. The reduction of the rainfall in a region like eastern America would undoubtedly result

* MacDougal, "The Water-balance of Desert Plants," *Annals of Botany*, vol. **26**, January, 1912.

† Ellsworth Huntington: 'Palestine and its Transformation' (pub. by Houghton, Mifflin & Co.), pp. 442; 1911. "Geographic Environment as a Factor in the Present Condition of Turkey," *Journal of Race Development*, vol. **1**; 1911 "The Fringe of Verdure around Asia Minor,'" *Nat. Geo. Magazine*, vol. **21**, p. 761; 1910. "The Lost Wealth of the Kings of Midas," *Nat. Geo. Magazine*, vol. **21**, p. 831; 1910. "The Karst of Southern Asia Minor," *Bull. Amer. Geo. Society*, vol. **43**, p. 91; 1911. "The Burial of Olympia: a Study in Climate and History," *Geographical Journal*, vol. **36**, p. 657; 1911. London. "The First Americans," *Harper's Magazine*, vol. **122**, February, 1911. "The Desert Laboratory," *Harper's Magazine*, vol. **122**, April, 1911. "The Greenest of Deserts," *Harper's Magazine*, vol. **123**, June, 1911.

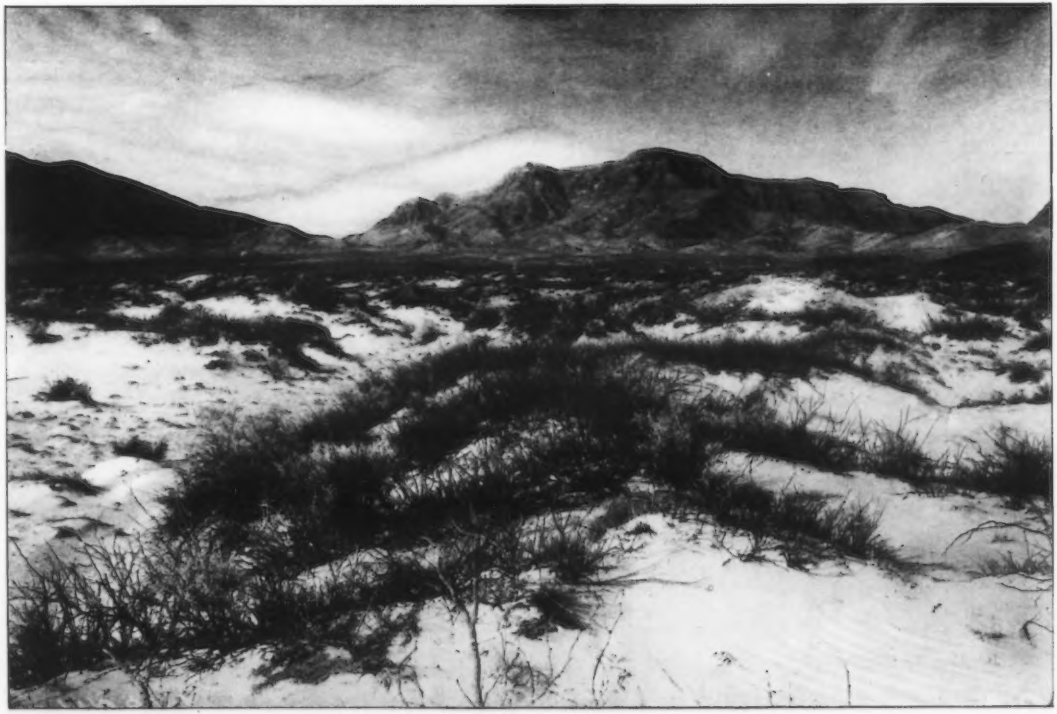


PLATE VII.—SAND-DUNES AND SPINOSE SHRUBS IN OTERO BASIN, NEW MEXICO.

PLATE VIII.—PIMA CAÑON, SANTA CATALINA MOUNTAINS, WITH SPINOSE AND SUCCULENT TYPES OF VEGETATION.

from changes in the flow of the wind in a year in which the principal features would be a single wet winter season and a dry rainless summer. The total evaporating power of the air would be increased. The disproportion between the annual maximum and minimum rainfall would be heightened, and the daily and the annual range of temperature would increase, chiefly by reason of a heightened maximum.

Next would come an interlocking series of changes in soils, stream flow, erosion phenomena, and in the distribution and composition of the vegetation. Broad-leaved plants and dense formations would be restricted to the margins of streams and the higher mountain slopes. The destruction of the existing vegetation would give greater scope to erosive agencies. Detritus would pile higher at the foot of mountain slopes, the run-off coming out of the mountain gulches would carry some of this loose material out into characteristic *bajadas* and also make *playas* in the lower valleys. The humus content of the soil would be lessened, the soil-moisture content would be decreased to such extent that the capillary column to the surface would be broken, plants would no longer find a supply deep in the ground, and the types which survive would be those with horizontally disposed root-systems of the spinose or succulent forms. The saline deposits formed in the valleys would become suitable for the salt or beach plants.*

Many streamways † would show only an intermittent flow, lake-levels would be lowered or dried up, and their wind-swept bottoms become piled with dunes. The action of the wind on slopes of loose unassorted material would tend to carry away the sand and finer particles, allowing the coarser pebbles to sink in place, forming a perfect pavement with an exposed surface polished by wind-borne sand. Meanwhile the animal population, including man, would show adjustments to the slowly changing supply of water and food. Habitats and habitation sites would be abandoned, and all would become tributary to fewer centres of supply. Greater tensions and fiercer competitions would be set up, and many races would perish, while the surviving elements would necessarily be forced into new interrelations.

Now, let us suppose the pendulum of variation were to swing slowly back toward humid conditions. The disproportions between precipitation and evaporation would decrease, and the annual rainfall become more regular. The spreading out of broad-leaved plants from the stream-margins would give a denser covering of vegetation, increase the humus in the soil, and check erosion by wind and water. Drainage lines would be connected into a living system of streams extending to the sea, cutting

* MacDougal, "Origination of Self-generating Matter, and the Influence of Aridity upon its Evolutionary Development," *Journal of Geology*, vol. **18**, p. 603; 1909.

† E. F. Free, "Studies in Soil Physics," *Plant World*, vol. **14**, pp. 29, 59, 110, 164, 186, 1911.

and dissecting the *bajadas* and filling up the basins to overflowing. Some plants of the desert types would survive on the drier slopes in the sunniest exposures.

The observer who examines a region for evidences of climatic variations of the kind indicated might see the upper portions of detrital slopes hanging to the mountain bases, as well as dissected *bajadas*, saline and wind deposits exposed by stream action in a humid climate. In a desert region, the terraces of lakes and streams, traces of ancient stream flow, remains of human habitations and desiccated plant remains might be taken together as indicative of conditions prevalent in times past. The structure of the great trees of California, which reach ages of twenty to thirty centuries, have been recently examined by Professor Huntington, and it seems probable that when corrections for age and locality are applied to the measurements of the annual rings, some evidence of value as to climatic fluctuations may be obtained. The completion of the computations will be awaited with much interest. A discussion of this and other phases of the problem as to climatic fluctuations lies without the scope of this paper. My present purpose has been to describe and define some of the meteoric, hydrographic and organic agencies, which interlock to make the complex and distinctive conditions of the desert.

The PRESIDENT (before the paper): The reader of the paper to-night, Dr. MacDougal, is a graduate of two American Universities, and has held various appointments. He was Assistant Director of the Botanical Gardens in New York for six years, and is now Director of the Desert Laboratory which has been established in Arizona by the Carnegie Institution of Washington. He has been engaged in exploration and other geographical work in the deserts of North America during the past twenty years, and some of the results of his work he will present to us in the paper we are to listen to to-night. He is the author of several works on his own subject, which is botany, and of various scientific papers. He is a botanist by training, but his desert researches have led him to give very close attention to the geographical conditions affecting botanical distribution. The Carnegie Institution of Washington with which he is connected was founded by Mr. Carnegie in 1902, and its purpose of research has been carried out by the organization of facilities for investigation in various fields which might not be readily occupied by members of University Faculties with the opportunities usually available to them. Many eminent scientists have been brought into connection with the Institution as research associates, while special staffs have been called together to co-operate in seeking the solution of closely related problems, such as those grouped in the programme of the Solar Observatory; the results of the extended surveys of the Department of Terrestrial Magnetism are also probably known to many members of the Society. These are the credentials of the distinguished gentleman whom I will now invite to address you.

Mr. GODFREY SYKES (after the paper): I am sure that Dr. MacDougal has left but little more to be said, but there is one point which he has touched upon which I should like to emphasize a little more. The desert regions in Western North America are a series of more or less isolated areas, extending generally in a north and south, rather than an east and west, direction. In other words, their existence depends not so much upon latitude as upon mountain slope and aspect. The

range of mountains extend in general in a direction west of north and east of south, or roughly parallel to the western coast-line, and quite frequently present a very abrupt face to the east.

The most intense desert conditions exist, as Dr. MacDougal has already pointed out, immediately to the eastward of these mountain ranges, and will gradually become less intense, and merge into a region in which vegetation can more easily exist as one passes from the vicinity of the mountain and out into the plain.

This is true of nearly the whole western slope of the continent, until one approaches the crest of the main divide; when the increased elevation and consequent precipitation more than compensates for the dryness due to the lower western barriers.

The plains of the great interior basin, which extend from the mountains eastward to the Missouri river, were also spoken of by the earlier voyagers across them as the "great America desert," but this was perhaps due in the main to their own lack of experience in such a region, and also to the fact that their equipment and technique of travel and camp was not fitted for such a journey, and so they frequently underwent great hardship in getting across.

The so-called desert area in the west has, however, gradually diminished to such an extent, and the remainder is becoming so well known, that we are at present extending our search for typical arid areas further afield, and are at present *en route* for Egypt in quest of a real desert.

Captain LYONS: The wearisome monotony of desert scenery is that on which in most cases stress is laid by those who travel in deserts, but I think all have realized to-night that there is a great deal of information and interest to be extracted from even the most arid desert. What interests me personally so much is to see that in these American deserts almost every feature, every phenomenon that I am familiar with in the deserts of Egypt, is repeated here again, as is natural, since under the governing conditions of a very scanty rainfall, a great range of temperature, and an area where wind action has full play, the results in all arid regions are naturally very much of the same type. Dr. MacDougal has perhaps chosen his photographs so as to show areas where vegetation is best developed; I do not know, but from the Egyptian point of view, I regard the vegetation we have seen in his lantern slides as almost excessive for a desert, though perhaps I should rather compare them with the eastern desert of Egypt, to the east of the Nile, where there are high ranges of mountains, and where the conditions in their valleys are perhaps more akin to those which he has shown us than in other parts. In the western desert, towards the western oases, except in the oases themselves, there is vegetation here and there, but it is very scanty indeed and hardly to be seen in most photographs of the desert surface that are taken. The western desert, I believe, will interest Dr. MacDougal extremely, from that point of view of its extreme aridity; also I hope he will have time to visit the shores of the Birket Qarun in the Fayum depression, where there has been a sinking lake-level since the Middle Kingdom of Egyptian times, and where he will see those features that he has shown us round the Salton lake very well shown by the vegetation round the present lake margin.

Mr. FRANCIS DARWIN: Dr. MacDougal has given a most vivid and interesting account of the American deserts, and has incidentally demonstrated the value of his desert laboratory for ecological and physiological work in botany. I have one question to ask. Dr. MacDougal referred to Fitting's interesting work on desert plants with high osmotic pressure. Fitting describes certain plants

which no one would imagine could exist in a desert, they being neither of the succulent nor of the spiny type. They had broad flat leaves with a delicate cuticle and unprotected stomata, so that they were absolutely of the non-desert type. Yet they lived in the very dry country near Biskra, and they did so entirely by possessing a high osmotic pressure which enables them to tear the water out of a soil so dry that it baffles the ordinary plant. I should be glad to know whether this type has been found in America.

Prof. A. C. Seward: I am glad to take this opportunity of expressing the great pleasure that it has been to me, and I am sure to many other botanists here, to have heard Dr. MacDougal's lecture to-night. For some time past English botanists have watched with very great interest the work which has been going on in the Desert laboratory. To-night we have had brought home to us much more vividly than is possible in a written account the enormous interest and importance of the work which has already been done and is still in progress. One aspect of the lecture which especially interested me is the striking illustrations which Dr. MacDougal's account of his work has given of what he calls the conjunction of sciences; the research that is being done in the Desert laboratory throws light not only on purely botanical questions, but also on geological and many other problems. Those who are more especially interested in studying the plants of past ages endeavour, so far as they can from the available data, to find out something of the changes through which different parts of the world have passed—changes such as are registered in the different kinds of plants preserved as fossils. New observations on desert vegetation such as have been outlined this evening afford very important evidence from this point of view.

Mr. Douglas Carruthers: If Dr. MacDougal wants to see a real desert, he must go to Arabia. I assure him he can travel there for two weeks at a time and see nothing but black stones—no vegetation whatever. Listening to his paper on the extremely interesting data which he has collected, naturally makes one rather eager that the work should be continued across the arid regions of Central Asia—the very home of arid desert and isolated inland drainage. During a recent expedition I touched on no less than ten of these isolated inland drainages, and found them full of interest. The basin of the sea of Aral, for instance, has, I believe, a total rainfall of about 4 inches; but the sea of Aral takes something like 2500 cubic metres per second of water from the great rivers, the Oxus and the Daria, yet the whole of this water is taken up by evaporation; so I think the evaporation probably in Central Asia is greater than what it is in America. His remark on the adaptability of man and animals to the waterless surroundings is also of great interest, and corresponds exactly with what I noticed in Arabia. I repeatedly came across large antelope, which exist in a country which is entirely rainless for ten months of the year, and there is no possible chance of its getting water for ten months out of the twelve, except small juicy desert plants which they dig up out of the sand, and I believe, in the Sahara, antelope lives in the same way. In the Kalihari desert, in South Africa, the Bushmen are supposed to exist for a considerable time on small water melons which grow there. If Dr. MacDougal has a chance of visiting Central Asia and Arabia, he will find them of surpassing interest.

The President: I am sure you will wish before we separate that I should express your thanks to Dr. MacDougal for his lecture. It was a most interesting paper delivered in a very pleasant style, illustrated by excellent slides and characterised by an agreeable and strictly American flow of humour. I agree with the last speaker, knowing something of the deserts of Central Asia myself. When Dr. MacDougal has exhausted the deserts of Egypt, or rather, when they

have exhausted him, I hope he will move on to Central Asia; and certainly, having seen some of the deserts there, I can promise him something compared with which his pictures of the outlook from the Desert laboratory which he himself inhabits in Arizona, suggest a perfect garden of Eden. There was one other feature of his lecture which impressed me strongly; it was this. It is one of the privileges of the President of the Society to have placed in his hands a printed copy of the lecture which the hero of the evening is about to deliver. I had my copy of Dr. MacDougal's lecture, and satisfied myself that it would be most striking and erudite. But when I came here, I found that Dr. MacDougal, captivated by his own slides, delivered an entirely different lecture. Therefore I must congratulate the Fellows of the Society, because alone to-night, so far as my own experience extends, we have succeeded in obtaining two lectures from the same man. First, there was the address which Dr. MacDougal delivered to us just now; and later on, when the original essay appears in type, imagine the elation of every one when he finds he has secured a second lecture for the same money.

VOLCANIC CRATERS AND EXPLOSIONS.*

By TEMPEST ANDERSON, D.Sc.

THE subject of Volcanoes naturally divides itself into two branches—the Physiographical, or naked-eye one, and the Petrological, which latter deals with the chemical and microscopical structure of the rocks produced. This branch has by itself provided the subject of life-studies by such men as Sorby, Bonney, Teale, in this country, to say nothing of foreign investigators almost equally distinguished; but it is extremely difficult and complicated, and I do not propose to discuss it to-night.

The other branch deals with the physiographical phenomena of volcanic cones, craters, and lava streams; with deposits of pumice, tuff, ash beds; with dykes, sills and intrusive sheets, their structure and mode of production, and their alteration by weathering and other forms of denudation. It may fairly be included in physical geography, and is, therefore, suitable for consideration by this Society. Even this is far too large a subject to be dealt with in a single lecture, so to-night I shall confine myself chiefly to one division of it, viz. Craters and Explosions, and only mention the other branches incidentally and by way of illustration.

If we watch most volcanic eruptions, small enough to be safely approached, such for instance as that of Vesuvius in September, 1898,† we see a discharge from the crater of vast quantities of dust and ashes suspended in steam and various volcanic gases,† while lower down the cone is a discharge of lava, building up in this case a hill, Colle Umberto primo.

These mark two very distinct factors, and according as one or other predominates, the eruption may be classed as of the explosive or effusive type. Thus the eruption of the Soufrière in St. Vincent in 1902 was wholly explosive, no lava being discharged, while in those of the Hawaiian and

* Royal Geographical Society, November 20, 1911.

† Slide shown.

some of the Icelandic volcanoes enormous volumes of very fluid lava are often discharged with scarcely any explosive action.

The early stages of an eruption are often explosive, and the ejecta fragmentary or vesicular in character (ashes, lapilli, pumice), while later on when most of the gases have simmered off the lava flows steadily and cools into a compact mass. Thus the cone of the Campo Bianco † (white field) in Lipari, from which practically all the pumice stone of commerce is obtained, was evidently formed in the early stages of an eruption, during the later stages of which the obsidian stream of the Roche Rossi (red rocks) were formed. The chemical composition of the two is practically identical, while the diverse mechanical structure makes all the difference between the vesicular pumice and the compact obsidian (volcanic glass).

Among the simplest examples of cones are those formed during a single eruption † ; some of these consist of little more than a hole drilled, or rather punched, through the Earth's crust, while the material thrown out by the escaping gases, and which has fallen down around the vent, may consist chiefly of volcanic ash, perhaps mixed with a varying amount of fragments torn off from the country rock,† though in most cases the former much predominates. Occasionally natural sections, like that made by the waves in a tangential direction on the cone of Vulcanello in the Lipari Islands,† or artificial, as where a cutting for a road has been made in a radial direction into the crater of Astroni,† near Naples, expose the structure and show that the beds of ash, pumice, etc., all dip outwards from the centre of the crater,† while if the sections of the beds can be traced round the inside walls of the crater, they appear horizontal.† The inside of the crater is, however, often much obscured by masses of talus, formed of material which has either fallen short of the crater rim or tumbled afterwards from the cliff, the dip of which is of course towards instead of away from the centre. Few cones are, however, so simple as this, especially if they have been the site of repeated eruptions—parts of the cone have been blown out, and the crater enlarged ; and this again has been filled up, wholly or in part, and then re-excavated, perhaps repeatedly. Vesuvius, with its old crater ring of somma partly surrounding it and its big recently enlarged crater, are familiar examples.†

Volcanic explosions have been divided by Professor Mercalli, of the Vesuvian Observatory, into two types, the Strombolian and Vulcanian, according as the gases escape from among materials, more or less fluid or pasty in the first case, or already solidified in the second.

Stromboli † and Vulcano † are both islands in the Lipari Group, north of Sicily, and near enough to be in sight of each other, yet in most respects they present the most diverse characters.

The lava in general consists of silica, which is combined with various bases, of which alumina, iron, and lime are among the most abundant.

† Slide shown.

MATAVANU, SAVAII. CORDED LAVA ABOVE HIGH-WATER MARK, PASSING INTO PILLOW-LAVA BELOW.

(*T. Anderson, photo.*)

THE CRATER OF KILAUEA, HAWAII. SHOWS REMELTING OF LAVA.

(*T. Anderson, photo.*)

STROMBOLIAN EXPLOSION, STROMBOLI.

(*T. Anderson, photo.*)

LAKIS KRATERE, SKAPTA LAVA, ICELAND. A FISSURE ERUPTION.

(*From Tempest Anderson's 'Volcanic Studies.' Murray.*)

In that of Stromboli, the basic constituents predominate, and the lava is mostly dark coloured, heavy, and readily fusible, while the explosions take place with such frequency and regularity that the mountain is called the lighthouse of the Mediterranean. A typical Strombolian explosion † takes place from a more or less molten mass of this fusible lava, and pasty, red-hot masses are projected high in the air, and often rise so high as to have time to assume ovoid or almost globular forms, and be sufficiently chilled on the surface to retain these forms on falling † ; while the escaping gases are often free from dust and chiefly transparent.

On Vulcano, on the other hand, the lava is mostly of a highly acid type, and consequently fusible only with difficulty. The eruptions take place only at intervals of many years, and are then of paroxysmal violence. The explosions † taking place from among the more or less solid materials, carry up entangled in the gases enormous volumes of finely-divided materials (ashes, scoriæ, lapilli, being names applied to different varieties differing mainly in size). The clouds thus produced † often assume forms like cauliflowers † or bunches of grapes, which, though characteristic of this type of eruption, are not confined to volcanic sources. They may be observed when finely-divided particles of soot, suspended in gases at a high temperature, escape from the chimney of a steamer,† as well as from that of a volcano.

The bombs thrown out by this type of eruption are often more or less solid on the surface, at the moment of explosion, while the interior is yet pasty, and still contains imprisoned gas. When in the air the pressure is reduced, and the gases are liberated in vesicles or bubbles, like those in a bread loaf, and the crust gives way owing to their expansion, and produces blocks with an appearance which has procured them the name of bread crust bombs.† I have seen such also among the West Indian volcanoes and also those of Central America.

Though the above types of explosions are named after Stromboli and Vulcano, and are mainly characteristic of them, it does not follow that no explosions of other types are observed on those volcanoes. On the contrary, I have observed and photographed well marked Vulcanian explosions on Stromboli † in 1904. So much for the explosive factor in eruptions.

I must now deal rapidly with the other aspect, the effusive (*fundo*—I pour) or efflusive (*fluo* — I flow). Occasionally the molten magna rises without explosion to the rim of the crater and flows down the side of the cone as a stream of lava: more commonly it insinuates itself as a dyke † or as an intrusive sheet † into cracks or fissures in the substance of the cone, and comes to the surface, somewhere near its foot. If it still contains much steam or other volcanic vapour, this tends to expand and form vesicles and bubbles, in fact, red hot froth, and this solidifies into the well-known cindery or scoriaceous lava.† This often floats on the surface

† Slide shown.

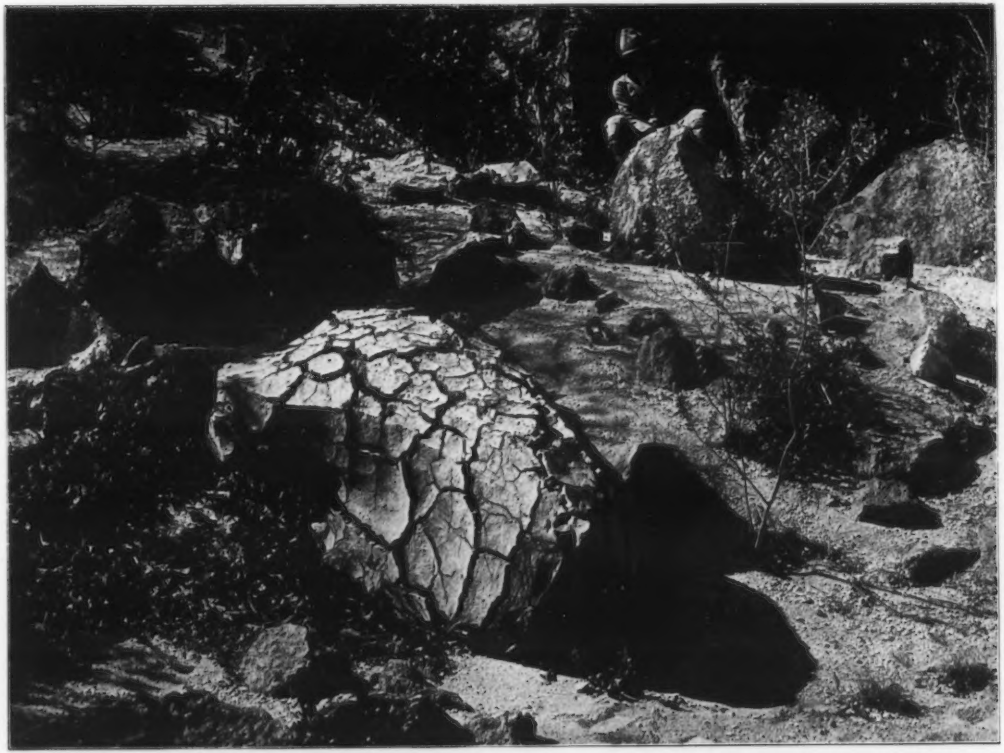
of the still liquid, or, at any rate, pasty lava underneath, and rolls down the ends or sides of the stream with a very characteristic noise. Large fields of lava are thus commonly formed, covered with great rough, sharp-edged blocks, and they present an almost impassable barrier to locomotion. If the lava underneath the layer of scoriæ retains sufficient heat to remain liquid long enough it parts with most of its imprisoned vapour, and may eventually emerge from under the covering and begin to assume the form to be next mentioned. Quite often, however, it originally contained little vapour, or has already lost the greater part when it comes out, and in this case it flows at once with a smooth surface. In either case this molten surface rapidly loses heat, and becomes treacly and viscid. The flow still continuing, this viscid layer is carried forwards and pushed up into a ridge like a cord, and solidifies in that form; while the same happens to the surface of the portion which follows, so that another cord is formed behind the first, and the process is repeated till the stream or sheet of lava is entirely covered with corded structure. I watched this process on the Colle Umberto primo, the new hillock that formed on Vesuvius near the observatory in 1898. The lava streams which were often numerous, were constantly cooling and giving place to new ones. They were not conspicuous by daylight, though they could be readily traced by the pale blueish vapour which they gave off.† At night, however, the red-hot lava became conspicuous in the darkness. A party of us watched the wonderful phenomena on every evening from the top of the observatory, and I was even able to secure photographs † of the streams by the light they themselves furnished. These lava structures must be contrasted with the products of explosive eruptions, such as ashes, scoriæ and pumice.

The great eruption of the Soufrière in St. Vincent was entirely explosive, and the ejecta were in places 200 feet thick. They consisted chiefly of ashes with a certain number of ejected blocks, and the secondary phenomena produced by the contact of rain water with the hot ash were very remarkable.*

The eruption of Santa Maria † in Guatemala, in 1902, was also entirely explosive. The mountain was previous to the eruption a very regular cone, about 12,600 feet high, with only quite a small crater in the summit. By a series of tremendous explosions lasting two nights and a day, an entirely new crater was blown out of one side of the mountain. As nearly as I could measure it, it was seven-eighths of a mile in its longer diameter, and five-eighths of a mile in its shorter, while the precipice exposed in the side of the mountain was at least 5000 feet, say upwards of a mile, high. It is worth remembering that the corresponding precipice left after the eruption of Krakatau in 1883, which has hitherto been considered one of the largest on record, is only about 1200 feet high. In both cases

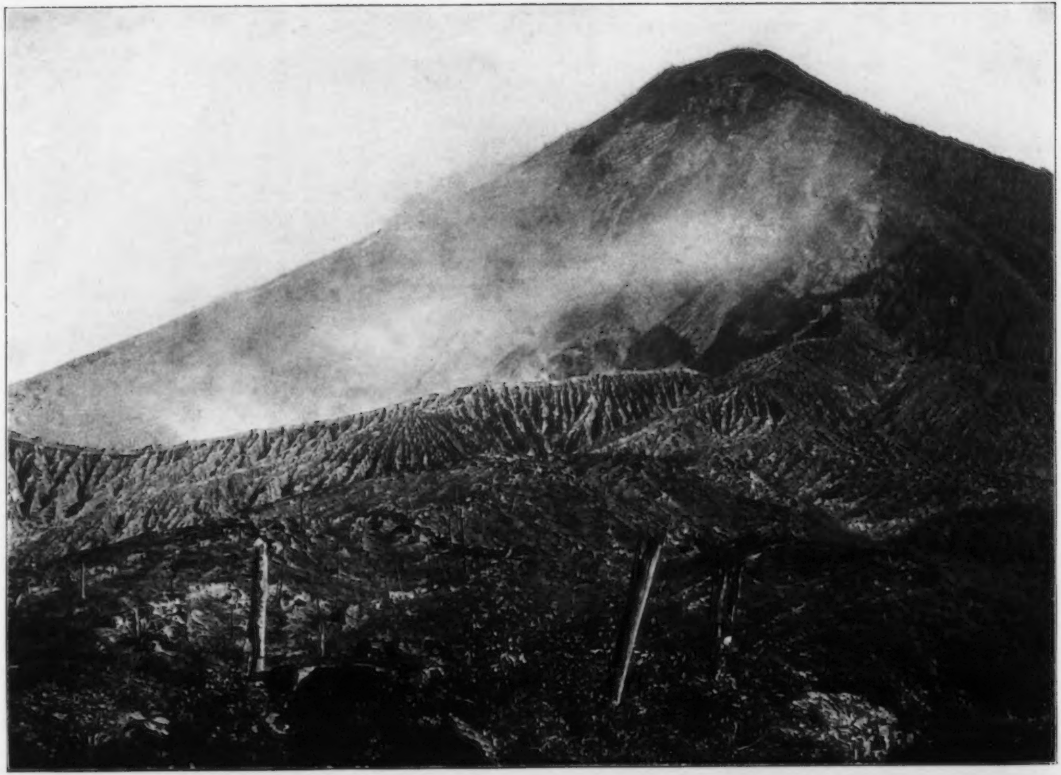
* T. Anderson and J. S. Flett, *Phil. Trans.*, part i. 1902, parts ii. and iii. 1907; T. Anderson, *Geographical Journal*, 1902.

† Slide shown.



BREAD-CRUST BOMB IN THE CRATER OF CERVO QUEMADO, GUATEMALA.

(*T. Anderson, photo.*)



EXPLOSION CRATER OF SANTA MARIA, GUATEMALA. SHOWS DENUDATION OF ASH DEPOSIT.

(*T. Anderson.*)

also the dust was carried into the higher regions of the atmosphere, and gave rise to remarkable sunset effects.* The surrounding country for many miles was devastated and a large number of lives were lost, but the place is so remote that the eruption did not attract the attention it deserved.‡

The ashes in these two last eruptions, and also in that of Tarawera in New Zealand in 1886, are consolidating by time and pressure into tuff, a soft porous rock, which by the action of rain and streams shows a characteristic feather-like pattern on the surface, and weathers into remarkable ravines.†

The Tarawera eruption was a fissure eruption, a class which has of late attracted much attention. A series of small craters opened along the line of a great fissure several miles long, the chief action, however, being localized in Lake Tarawera, all the water in which was blown out, and the pink and white terraces which formerly existed there were totally destroyed. Percy Smith, formerly Surveyor-General of New Zealand, who was one of the first party to visit the scene of the eruption, told me that he descended 500 feet into the crater which opened in the floor of the lake, and which is now again filled with water.§ Fissure eruptions are also common in Iceland, and are generally accompanied by the discharge of enormous volumes of very liquid basalt lava. The historic eruption of the Skapta Jokul † in the latter half of the eighteenth century was of this class.‖

When the early part of an eruption has been explosive, and a cone has been built up in the manner described, the magma which rises in the volcanic chimney (or vent) tends, towards the end of the eruption, to have parted with most of its contained vapour, and the mass often cools and solidifies in the form of a plug, which has been supported by the materials of the cone, acting as a sort of mould or matrix. If now the soft ashes are removed by any of the processes of subaereal denudation, for instance by the action of a river, the plug may remain standing and is called a volcanic neck.† Such are not uncommon, and good instances occur on the Rhine between Bonn and Coblenz, where they consist of columnar basalt, and at Le Puy en Velay in Central France, where the Rocher St. Michel † consists of a mass of agglomerate, *i.e.* angular fragments of volcanic material, which had been churned up and down in the chimney while hot and finally become coherent.

A variation of this process has produced the Domitic Puys in Auvergne, of which the Grand Sarcoui † is one of the best examples. The lava as it issued was so pasty and viscid that it did not run down as a stream, but formed a rounded flattened dome between two cones of fragmentary materials, one of them very perfect, both of which appear to have been formed in the early part of the same eruption.

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* Verbeek, 'Krakatau,' also 'Report of Royal Soc. Com.'

‡ T. Anderson, *Geographical Journal*, 1907.

† Slide shown.

§ See his Official Report.

‖ Helland, Lakis Kratere.

A further stage of the same process occurred in Mont Peleé, in Martinique, in the great eruption of 1902, in which the city of St. Pierre was destroyed. A dome was first formed in the bottom of the old crater, but did not nearly fill it. The material of which it was composed contained large volumes of dissolved gases, and broke down as described above in the case of the Soufrière of St. Vincent. The incandescent mixture passed out through a V-shaped notch in the side of the crater, rolled down the mountain-side as an avalanche, and destroyed St. Pierre.

As the eruption became less violent a plug formed in the volcanic chimney as above described, and being pressed forward from below, forced its way through the dome, and formed the famous spine.† It rose to a height of about 800 feet above the top of the mountain, and it is believed that material to the extent of above 1000 feet was actually pushed out; but it was crumbling away all the time, and when I ascended the mountain twice, about five years later, only a rounded stump was visible, with a ring of very active fumaroles marking its junction with the dome, and with the talus of fallen *débris*.

In the old world we are accustomed to regard volcanoes as mainly responsible for the discharge of material and the building up of cones and deposits of lava and tuff, but in the new world, and especially in the Pacific, the geologists are accustomed equally naturally to invoke the agency of subsidence as the cause of any otherwise inexplicable hollow. During a recent visit there I took the opportunity of examining as many as possible of such real or supposed subsidences, and I select for our present discussion some of the most characteristic.

In an ordinary explosion crater, towards the waning of the eruption, there is often deposited a large bulk of material containing clay and various sulphur compounds. The gases which rise from the vent during the solfatara stages often also contain sulphur compounds. These, by contact with the air, tend to become oxydized into sulphuric acid, which, combining with the alumina of the clay, forms alum. Water percolating through this dissolves and removes the alum, and subsidence of the surface takes place. Such undoubted subsidences vary in area from the size of an ordinary sitting-room to several acres. Many such subsidences are found in the volcanic district of New Zealand, as at Waiotapu,† Roto Kawa, and Wairakei,† and of the reality of the cause in their cases I feel no doubt, but it is more difficult to accept it when a lake several miles in diameter is under consideration, and where no remains of alum beds are visible.

The great volcano of Kilauea in Hawaii, or Owyhee as it used to be called, is a good example of the type of efflusive volcanoes as they occur in the Pacific, and its crater is often quoted as an example of a subsidence. The lava discharged from it is so fluid that the slope of the outside of the cone is only 5° or 6°, and in places I believe as low as 2°, so that the crater appears to be more a hole in a plain than in the top of a mountain, while

† Slide shown.

MONT PELÉE IN ERUPTION. A FORM OF VULCANIAN EXPLOSION.

ROCHER ST. MICHEL LE PUY, CENTRAL FRANCE. VOLCANIC NECK.

From Tempest Anderson's 'Volcanic Studies' Murray.)

SCORIACEOUS LAVA OF 1886, NEAR NICOLOSI, ÆTNA.

DETAIL OF A LAVA-STREAM IN THE FOSSA VETRANA, VESUVIUS. CORDED LAVA IN FOREGROUND.

(From Tempest Anderson's 'Volcanic Studies.' Murray.)

there is singularly little evidence of explosive action, such as the presence of ash, lapilli, or ejected bombs, all of which are very infrequent even right up to the brink of the crater. The details of its structure were shown by the aid of a series of photographs taken during a month's stay at the volcano house. These showed among other things the lake of liquid lava, partly crusted over, and with the crust broken up by a series of cracks, through which the red-hot molten lava was visible at dusk, and which were photographed by their own light, as was Old Faithful, the great fountain of molten lava, which usually plays at intervals about once a minute or oftener. Bays were also formed in the crater during this visit by the remelting of parts of the black ledge † of lava. They were comparable in size to the quadrangle of Burlington House, and the lava which was remelted was entirely removed.

Matavanu is a new volcano in Savaii, an island in the Samoan group, which only came into existence in 1905. Its crater † contains a lake, or rather river, of molten lava, comparable to, but more active than, that of Kilauea. The incandescent lava is so hot as to appear white-hot, even in tropical sunlight, so fluid as to rise in fountains more active than those in Kilauea, and to break in waves on the walls of the crater. Finally, the lava rushes with the velocity of a cataract into a tunnel, or rather gulf, at one end of the crater, where it disappears and runs underground under the crust of a large lava-field † for a distance of 10 miles to the sea, into which it falls with tremendous explosions.† Its course under the lava-field is marked by a number of large pits or fumaroles,† which appear to have been formed by the remelting and falling in of the crust over the tunnel. They are very similar in structure † to the pit craters of Hawaii,† the origin of which has given rise to so much discussion, and which were possibly formed in a similar manner.

As the lava at the seaside escapes from under the surface crust, it, where the action is not sufficient to set up explosions, begins to form lobes like those of ordinary corded lava †—and this corded structure is, in fact, formed in the usual manner in places above the water-level. Where, however, it falls direct into the sea, the surface is chilled before there is time for it to be wrinkled up into the corded structure, and it becomes consolidated into the characteristic form of one variety of pillow-lava.† This mode of formation, though previously on other grounds suspected by geologists, was, it is believed, first actually watched by the author in 1909.

The PRESIDENT (before the paper): The reader of the paper to-night, Dr. Tempest Anderson, bears a name well-known to geographers. Many of you here present are familiar with the work he has accomplished in connection with some of the greatest volcanoes in the world, and with the magnificent photographs with which, when he lectures to us, he illustrates their activity, and the effect exercised by them upon the surface of the globe, which is, of course, the main study for which geography exists. Eight years ago Dr. Tempest Anderson

† Slide shown.

gave, at a meeting of this Society, at which I had not the good fortune to be present, an account of several terrible volcanic outbreaks which had occurred in the West Indies, and three years ago he gave an equally instructive paper on the volcanic phenomena of Guatemala. Probably no one in this country has seen more volcanoes or more eruptions, fortunately so far without injury to himself, than our lecturer this evening, and to-night he will take us to several typical volcanoes in various parts of the world, and by means of his own descriptions and a fine series of slides, will illustrate the different kinds of explosions and the various character of craters. I will now ask Dr. Tempest Anderson to deliver his lecture.

Dr. STRAHAN (after the paper): I think you will agree that it has been a great privilege to see this wonderful series of photographs of Dr. Tempest Anderson's, gathered from all parts of the world in which volcanoes are active. The British Isles have been said to contain a sample of everything connected with geology—to be in themselves a perfect little museum, but there is one thing which they do not possess, and that is an active volcano, though I do not mean to say that that is a matter for regret. But if we have no active volcanoes we have many dead ones. The British Isles are situated on the margin of the European-Continental area, in a position where land and sea meet, and in which volcanoes are frequently developed. We may, therefore, suppose that our freedom from active volcanoes at the present moment is temporary. Of course in past times there has been plenty of igneous action in the British Isles; for example, some of the Western Isles of Scotland are the remains of a prodigious mass of basalt which was poured out, as supposed, from a fissure, for no volcanic cone appears to have been reared, but a long crack opened in the crust of the earth, from which lava welled out in huge quantities. The islands I refer to are merely remnants of that huge mass which have been left by the sea. But what I have in my mind at the moment is a beautiful study of the results of a volcanic outburst which may be seen in the cliffs near Weston-super-Mare. There, in the Carboniferous limestone teeming with fossils, you may see proof that the bed of the sea was suddenly overspread by lava. The molten rock, cooling more or less quickly under the sea, developed that peculiar structure which has been alluded to by Dr. Tempest Anderson as pillow-structure. Here, therefore, is a case in which his studies of lava flowing into the sea have proved of much value to geologists, for they enabled us to see under what conditions it could happen that the lava should be divided up into huge pillow-like masses with limestone in between. While this eruption was going on all the organisms were driven away. But presently the lava ceased to flow, and then some of the organisms began to struggle back, but only a few of the more hardy species, for the rock which lies next above this lava consists chiefly of volcanic ash. There were for a time alternations of coarse and fine ash, but gradually the showers abated and the water cleared. The episode came to an end, the teeming fauna of the Carboniferous-limestone period overspread the spot, and perfect tranquillity reigned. All this is recorded in the cliff, and anybody can see it by hammering over the rocks. But after all the rocks are so to speak dead, and it is as well that we should know what the scene was like when the volcano was alive. Apart from witnessing an actual eruption, there is no better way of realizing the scene than having the great privilege of seeing a series of photographs presented by Dr. Tempest Anderson. The series has been got in the course of many years at considerable expense and trouble, and I expect (though he has not enlarged upon that subject) with no little personal risk.

Mr. BRUCE MITFORD: I have little to add to the interesting and instructive lecture which Dr. Tempest Anderson has given us, apart from a few observations

which have come under my notice in Japan. A good many people are inclined to look upon the subject of volcanoes with a kind of mild contempt. Not an hour ago I heard a gentleman describe the crater of Kilauea, which Dr Tempest Anderson showed us just now, as a "cesspool," adding that he certainly never wanted to see another. Similarly, the famous Fujiyama, in Japan, has been irreverently described as an "ash-heap:" but it is difficult to understand how any one who has looked into the crater of an active volcano can fail to feel a profound respect, not only for the volcano itself, but for the subject as a whole. Several years ago, I believe, Dr. Tempest Anderson published a most interesting book entitled 'Volcanic Studies in Many Lands.' I read that book in Japan with much appreciation; but I could not help reflecting, as I realized what very extensive journeys Dr. Anderson had to make to collect those very valuable studies, that, had he been resident in Japan, he could have found as many volcanic subjects, and certainly a greater number of active volcanoes, within a day's journey of Tokio. I understand, however, that Dr. Anderson finds himself unable to resist any longer the "call of the East." Japan is said to possess a special fascination for the visitor, and when that visitor is a vulcanologist, I am afraid the consequences might be so serious that we must reconcile ourselves to not seeing Dr. Anderson again for a considerable time.

I think it may be said that the science of vulcanology has suffered by being unduly localized. It has centred itself, to a large extent, about two particular volcanoes—Stromboli and Vesuvius—presumably because these are the most accessible. The literature that has accumulated itself about Vesuvius is enormous. I dare say some one with a genius for statistics would succeed in showing that it approximates in bulk to the volcano itself. Obviously this must have involved a considerable amount of repetition, and the science of vulcanology would have been richer if some of this energy in research had been expended on volcanoes in other parts of the world. Dr. Anderson is doing a good work in this direction, for he has shown us splendid subjects from a great many different lands. With regard to types of volcanoes, Prof. Mercalli of the Vesuvian Observatory, as you have heard, divides them into two classes, according as they resemble the action of Stromboli and Vesuvius respectively. However, any one visiting Japan, for example, would find volcanoes which could scarcely be brought under either of these headings. He would find a volcano like Bandaisan, which in a few seconds blew away an adjoining peak of the size of Snowdon, destroying four villages with their inhabitants, and covering with *débris* an area of 27 square miles, but without leaving behind a single trace of scoriæ, volcanic ash, or lava. Then, again, there is the volcano which is performing, in a very literal sense, the function of "terrestrial respiration"—such a volcano, for example, as that of Oshima, off the Gulf of Tokio, which seems merely to "breathe," in a series of gasps. Each gasp is a cloud of steam: nothing else happens, and this goes on incessantly. Then, again, you will find a volcano which emits a continuous torrent of steam from huge fumaroles in the floor of its crater without any explosive action; and, finally, you have a volcano like Asama, which seems to combine all these functions in itself. This volcano, for the last three years running, has signalized the approach of winter in a startling way. In the first week in December each year, almost to the day, a violent explosion has taken place within its crater, which was heard and felt in Tokio, 100 miles away, and suggested to most people an earthquake of unusual character, or an explosion of gunpowder at some factory near by. Curiously enough, when the volcano was subsequently examined, few, if any, traces of the outburst

were to be seen, beyond a few large stones scattered about the upper surface of the cone. Such examples of volcanic action as these hardly come under the heading of those mentioned by Prof. Mercalli as either Strombolian or Vulcanian. As to the question of subsidence, it seems to me that the chemical theory does not suffice to account for the vast majority of cases. It is of interest to note that nearly all the lakes in Japan are in the volcanic districts. Some of them are crater-lakes, pure and simple; but others occupy large shallow depressions at or near the bases of volcanic cones, are practically circular, and sometimes as much as 10 miles in diameter. The formation of such lakes must be explained on the more simple ground that the strata in the vicinity have collapsed as the result of the removal of vast quantities of material from beneath the surface through volcanic agencies.

The PRESIDENT: I believe there is no one else who is prepared to address us, but I am quite sure you will not wish to separate without moving and carrying a vote of thanks to the reader of the paper. For my own part I should like to say that I never heard a paper read here which more impressed me with the conviction that the lecturer was a master of his subject. So markedly was this the case that he seemed, so far as I could judge, to be quite independent of his manuscript, and he talked as easily and well in terms of science as most of us talk badly in the vernacular. The same observations apply in a scarcely inferior degree to the speeches of the two gentlemen who were kind enough to address us afterwards, and who spoke with a very intimate knowledge of the subject, to which I cannot lay claim, although in olden days I have climbed to the top of a good many volcanoes in different parts of the world. When Mr. Bruce Mitford was talking to us about Japan and about the fearful explosion of Bandaisan, which occurred some years ago in that country, I remember an incident which was mentioned to me by Prof. Milne, who as you know, is a great authority on seismology and kindred branches of science. I was in Japan shortly after that great eruption took place, which, as Mr. Bruce Mitford told us, blew out the entire side of a vast mountain and discharged a volume of material that succeeded in absolutely obliterating from existence several villages and killing many thousands of people. He said he had been in that neighbourhood just after the explosion, and he had naturally inquired how, even in spite of the suddenness of the eruption, the mortality had been so terrific, and how it was that no warning had been given to anybody of the imminent catastrophe; and he had ascertained that when the explosion took place there was one man, a native Japanese, who was looking after his herds on the side of the mountain and witnessed the occurrence. There was no reason apparently why he should not have warned the people living in the villages a little lower down. By an extraordinary accident he managed to escape himself, and when asked afterwards whether he had seen the explosion he said that he had, but in answer to the further question why he had not gone down to warn the people in the villages below he replied that he could not do that because he had seen a black fox and therefore knew that the eruption was an optical illusion. Apparently a Japanese peasant seeing a black fox is so firmly convinced he is bewitched, that he does not believe in any unusual phenomena that may occur at the same time. This suggests to us that when Dr. Tempest Anderson makes a journey to Japan, as we are told he is going to do, he will probably come across some specimens of the human race more simple than those with whom he is accustomed to deal. But however that may be, I can only hope that he will bring back from that country information and data that will take the shape of another lecture here at no distant date.

TRAVELS IN THE LIBYAN DESERT.*

By W. J. HARDING KING.

In 1909 I started to explore the huge unknown desert tract, bounded by Egypt on the east, Tibesti on the west, and Darfur and Wadai on the south. The northern portion of this desert has been traversed by many travellers, and recently some of the large inhabited oases that it contains have been mapped by the Egyptian Survey Department. But even in this northern portion fairly large areas still remain unsurveyed and unknown.

Two short journeys were made into one of these districts, lying to the north-west of Kharga oasis. It was found that the plateau existing here, which was always assumed to be continuous, was in reality honeycombed by a perfect labyrinth of small depressions, the character of which is best explained by the map. A curious feature of this district was the almost complete absence of any form of vegetation in these depressions themselves, although patches of small scattered bushes and grasses were fairly frequent on the plateau just above them. Another short journey was made along an old disused road due south from the village of Belat, in Dakhla oasis, but the results were uninteresting.

Most of the time, however, was spent in attempting to cross in a south-westerly direction from Dakhla oasis towards the southern end of Tibesti. A number of attempts were made in 1909, and again in 1911. All of the routes, however, are not shown on the map, as many of them were over practically the same ground. Guides who knew this district were unprocurable, even with the assistance of the Government, and beyond the vaguest native traditions no information could be obtained.

One day's journey south-west from Dakhla oasis a plateau running roughly from north-east to south-west was found, covered by an extraordinary number of rocky hills (*gour*). There were literally thousands of these hills; they were generally conical in shape, but sometimes flat-topped or domed. As a rule, they stood isolated, but in places, especially on the western edge of the plateau, they were joined together to form continuous ranges.

From one of these hills on the northern edge of the plateau the continuation of the scarp which forms the northern boundary of Dakhla oasis was visible. As, however, it showed only as a faint blue horizontal line, and presented no definite point to which a bearing could be taken, it was not found possible to survey it. It appeared to run in a west-north-westerly direction, and to get lower towards the west, until it finally became merged in the general level of the desert, which rises here somewhat rapidly towards the west and south.

* Map, p. 192.

The space between the plateau and this scarp was to a great extent occupied by the belts of crescent-shaped dunes that Rholf's expedition found. These dunes, in the neighbourhood of the hill from which they were seen, were all probably under 60 feet in height, though they appeared to be somewhat higher further north. The belts all ran in the same direction, viz. 352° mag.

These belts are shown on the map as being of the same width throughout their length, and of being continuous sand without interspaces, but in reality they consisted of small strings of north and south dunes running parallel to each other. In places these strings spread out laterally and joined together, forming a continuous belt, while in other parts they again became separated, leaving a sand-free interval between them.

At a camp in the north-eastern corner of the plateau the curious "song of the sands" was heard. This was on April 19, 1909. The week before had been unusually hot, and this was followed, on the 19th, by a cool, almost cold, day, with an overcast sky and slight showers at intervals. Towards sunset this was followed by a regular downpour, which, however, only lasted about a quarter of an hour. After sunset there was frequent vivid summer lightning. The sound began about 7.30 p.m. and continued at intervals until about 8. The sound was very faint; in fact, two of my men were unable to hear it. There were two distinct sounds; the one somewhat resembled the sighing of the wind in telegraph wires, and the other was a deep throbbing sound that strongly reminded me of the after reverberation of "Big Ben." The sky was about half overcast at 7.30, but the clouds had practically all cleared off by 8 o'clock. A few drops of rain fell between 7.50 and 7.55. The aneroid at 8.20 read 28·55 inches, the dry bulb thermometer read 59·5°, and the wet 56·0°. It was very difficult to determine the direction from which the sound came, but apparently it came from a place about a mile distant where the sand poured over a low scarp. The sound was a distinctly musical one, as opposed to a mere noise. Some of the dunes we crossed, which happened to be covered with a hard crust, gave out a hollow almost bell-like sound when trodden on, and I have heard of a place on the top of the plateau, to the north of Kasr Dakhl, that gives out a loud musical note when struck, but I was never able to visit it. Much of the surface of the plateau we crossed is covered with loose slabs of sandstone, and in many places this produces a tinkling sound like broken glass when kicked.

The whole of the plateau, so far as we could see, consisted of sandstone. No trace of the limestone cap was met with. It is possible, however, that this may exist on the higher ground to the west of our route. The sandstone varied considerably in colour; large areas were almost black, while in other places white, yellow, orange, rose-coloured, purple, and even blue rock was seen. Considerable areas of sharp sand-eroded

rock (*karnfish*) had to be crossed, including a particularly objectionable variety of erosion known, I believe, as *sofut*, which consisted of thin knife-edged veins of rock sticking up at an angle of some inches above the ground.

The hills on the plateau were of the usual desert type, being either pyramidal, flat-topped, or domed, covered with a layer of loose slabs of rock.

Considerable difficulty was at first experienced in crossing the plateau, owing to the extremely rough nature of the ground, which proved a severe trial to the soft-footed camels. Two of the journeys had to be cut short, a portion of the baggage left behind in the desert, and a retreat made to Dakhla oasis, owing to the camels falling lame from this cause. On the fourth journey over the plateau, however, an old road was found which led over much better ground, and no further trouble from lameness was experienced.

A number of these old roads were seen, one of which, from its size, must have been one of the main caravan routes crossing the desert. All of them, however, had been so long disused that they were almost entirely weathered away; it was only occasionally in sheltered places that they remained visible.

Migrating birds were frequently seen coming from the direction in which they led, and, as some of them were water-birds, it is very possible that some form of lake or swamp exists further out, which collects, perhaps, the moisture from the eastern watershed of the Tibesti range. Nearly all the old geographers place a large lake out here—Ptolemy's "lake of the mud tortoises." The crops of these migrant birds I shot contained seeds and olives. One of my guides told me that he had heard of this lake, and that he believed, but was not sure, that the name of it was "Wayta."

The utter barrenness of this desert is extraordinary. In the whole area mapped to the south and west of Dakhla no sign of water was seen anywhere, and though a certain amount of scanty dead grass was met with in two or three places, green vegetation was found in only two very small patches of bushes lying close together. The total number of these bushes was certainly under a dozen, yet in this arid waste they were of such importance for firewood and camel-food that no less than four roads converged to that point. We sunk a well here 30 feet deep, but no sign of water was reached.

In spite of the extreme barrenness of the desert, it supports, in some unaccountable way, a certain amount of life. In addition to birds, which in the majority of cases were migrants, snakes, lizards, and curious grotesque insects (mantids, apparently) were frequently seen. Moths were found at almost every camp. Fox and jackal tracks were seen in places several days from any known water supply, and the ubiquitous desert mice or their tracks were frequently seen. It is difficult to

imagine what these creatures can live on in such a country. Foxes and jackals, of course, could live upon the snakes, lizards, and mice. But in the almost complete absence of vegetation or leavings from the caravans, the presence of the mice seemed unaccountable. One was almost forced to adopt the explanation of the Bedouin that they lived upon stones.

Six days' journey from Dakhla oasis the southern limit of the plateau was reached, and we descended over a high scarp into a large depression beyond, the floor of which consisted of sandy, pebbly soil, free from drift-sand, except in the narrow dune belts. Three days further on a high double-peaked hill was reached, on the top of which the highest recorded altitude was obtained, viz. 2149 feet above sea-level. From the top of this hill an immense area could be seen.

This was the furthest point reached in 1909.

The highest point on this plateau is probably somewhere about 3000 feet on the hill-tops. Though no great height, this would be considerably the highest known ground between the Nile and Tibesti, the plateau, consequently, is a conspicuous natural feature in such a very monotonous country. But its chief geographical interest lies in the fact that it banks up on its northern face practically the whole of the sand belts found by Rholfs' expedition, and so forms the boundary of the great dune area. The "limitless sea of impassable sand" formerly supposed to exist here is entirely mythical. The few small belts the expedition crossed gave very little difficulty.

I could learn no native name for this plateau. The inhabitants of Dakhla all expressed an entire ignorance of its very existence, in spite of the fact that they resort occasionally to the north-eastern corner of it to quarry millstones. But possibly an old map in d'Anville's general Atlas may throw some light upon the subject. The eastern portion of this map was used by Sir Wm. Garstin to illustrate the paper he read before the Society on the sources of the Nile, to show the greater knowledge possessed by the older geographers in comparison with those of more recent date.

The western portion of this map exhibits the same peculiarity. It shows the twin lakes of Bahrain, which were only rediscovered within recent years. In addition, it marks two mountain ranges, both running roughly parallel with the existing ranges. The northern one called Mount Calmeri, and the southern range Mount Tantaneh. The latter d'Anville identifies as Ptolemy's Mount Girgeris. The position of Mount Calmeri is given as about 27° N. and between 26° E. and 23° E.; Mount Tantaneh appears between 24° 30' N. and 32° N., and in longitude from 26° E. to 24° 30' E. Bahrain, however, is placed in about 26° E. long. and 27° 30' N. lat., so the positions are probably considerably in error. It is possible that these two mountains are intended to represent the plateau that we found and the scarp to the north of Dakhla. But, on the other hand, they may stand for the Dakhla scarp and the small scarp to the north of Iddalia and Farafra.

In 1911, after spending some time in making a *depôt* at the two-peaked hill reached in 1909, a start was made with the intention of getting fifteen days out from Dakhla, and, if necessary, back again by the same road in the event of water not being found.

Unfortunately, these plans were upset by the guide, who, while scouting ahead, first emptied most of the water in the *depôt*, and then doubled back round the caravan, which was following him, evidently with the intention of getting at a line of tanks which had been left in the road—one at the end of each day's march—for the return journey. This necessitated a somewhat hurried return. It was then too late in the season to make another attempt.

In addition to the map, a collection of insects was made, which have not yet been identified. Also a botanical collection—fifty varieties; some head measurements and ethnographical data of the Dakhla natives; and a collection of over two hundred different Libyan grafiti, mainly from the Gubari road, between Dakhla and Kharga.

JOURNEYS IN THE MO-KARANGA (SOUTHERN RHODESIA).*

By R. N. HALL, author of 'Pre-Historic Rhodesia.'

BEFORE the railway first arrived in Rhodesia, and prior to the settlement in "outside" districts of but a very few adventurous European settlers, and when considerable portions of the country were practically virgin to the white man's foot, the writer was tramping in the more remote parts of Ma-Tebeleland and Ma-Shonaland, accompanied only by his native porters, being absent from civilization for some months together on single tramps.

These tramps had definite objects, such as: (1) the discovery, locating, and examining of ruins, and their full descriptions; (2) the discovery of pre-historic rock mines; (3) the discovery of Bushman paintings; (4) the charting of unsurveyed districts and ascertaining native nomenclature of hills, rivers, areas, and securing correct Chi-Karanga derivations of same; (5) discovering and plotting the topographical features mentioned in the Portuguese records (1485—1760) of these territories; (6) obtaining by personal observation and inquiry ethnological and philological *data* concerning the past and present Karanga nation (erroneously styled Ma-Holi, Ma-Kalaka, Ma-Surna, and Ma-Shona, etc.), whose pre-mediæval and mediæval country was and still is Mo-Karanga, and which comprised, with other large territories, the present Ma-Tebeleland and Ma-Shonaland; and (7) collecting native relics and articles for home and South African Museums, and generally assisting botanists with any new specimens met with.

* Map, p. 192.

In 1908, being anxious to continue my ethnological work among the Karanga, I studied our existing maps, which every one conversant with this country will admit to be very imperfect, and in some instances misleading, to discover what areas still remained uncharted by Government surveyors. With the assistance of such maps, and of information given me by Government surveyors, I found there was a large area of country still unsurveyed, and this covered the major portions of the Sabi, Motoirikoi (Mt. Telekine) and Rundi (Lundi) watersheds, and down south to the Portuguese and Transvaal borders. When working at Great Zimbabwe I had made several excursions into this area, but such had just touched the fringe of it. I had always known from native sources and from hunters that this area was rich in ruins and Bushman paintings. I started in June with my native porters, and we had a little over five months of dry season in which to tramp.

The accompanying map is only a section of such unsurveyed area, together with a few miles east and west of surveyed land included in order to link up the chart into its correct geographical position, which is between lat. 19° S. and lat. 21° S., and long. 31° E. and long. 32° E. Altogether, with digressions, the distance travelled on foot in going backwards and forwards throughout this area, some portions the second and third times, was about 1200 miles.

After leaving the higher altitudes the climate became exceedingly hot by day notwithstanding it was "winter." The nights were, however, bitterly cold. Our daily tramps were taken very leisurely, and at ruins, paintings, or some particularly interesting hill villages we camped for a couple or three days, of course taking innumerable photographs. Our health was splendid, though we passed through some low country where severe forms of malaria greatly troubled the local natives.

The net results of the five months' travel proved exceedingly valuable. About thirty fresh ruins were discovered; some I examined, measured, and photographed, and we heard of other large ones. All these ruins lay between Zimbabwe and the Sabi. Fully sixty different sets of Bushman paintings were found, and some of them were as fine as any to be seen in South Africa. In parts, the rocks on the open veld are simply smothered with paintings, this showing that when executed the Bushmen must have been living unmolested by Bantu tribes, and probably they date from some time prior to the arrival of the Bantu from north of the Zambezi. The freedom of the paintings from the portrayal of any recognizable Bantu object would appear to attest the great age of the paintings. The Karanga people met with were undoubtedly finer in every respect than those seen elsewhere, and, being unaffected as yet by civilization, appeared to live a more open and natural life. They employ their ancient language, Chi-Karanga, in its purer form, and it was strange to hear many words contained in Dos Santos' Chi-Karanga vocabulary of over three hundred years ago. The manner of life of these people, their customs, arts,

TYPICAL KARANGA FACES, SABI RIVER.

MR. HALL'S MESSENGER BOYS, LOWER LUNDI RIVER.

industries, traditions, and superstitions, were exactly such as are described in the mediæval records of these territories.

Some of the routes travelled evidenced mineral wealth, all so far perfectly virgin, save for pre-historic workings in the northern portion of this area, and at points near the Sabi. The formation rock of each locality is noted on the chart. Certain stretches of country, the Devuli especially, are exceedingly well wooded, while some large tracts of slate, quartzite, and ironstone are absolutely devoid of timber and water, and crossing which we had to carry a three days' supply of the latter. "Water" marked on the chart was water found at the close of the dry season,

The finest and most romantic hill scenery in the whole of Southern Rhodesia, not excepting even the Matopos (correctly, Ma-Dobas, "an area of uneven or rugged country"), is in N'Danga. This area ought to be cultivated by the tourist-sportsman from Europe. He would secure plenty of lions, and the alarms and excitements of camping out in this district for a month would provide subject-matter for any number of books. We saw lions frequently, singly and in troops of four and five, particularly near water an hour before sun-up. The ravages of these vermin formed the principal topic of the conversation of the natives at every village we came to.

Needless to say, the five months' walking in these remote parts brought in a mass of ethnological and other *data*. All my note-books were filled, as also every scrap of paper I possessed. The "boys" on their return were laden with specimens of all descriptions.

DETERMINATION OF THE ALTITUDE OF MOUNT HUASCARAN.*

In the *Geographical Journal* for April, 1910, Mrs. Bullock Workman gave a brief account of an expedition despatched to South America on her behalf, with the object of determining accurately the altitude of Mount Huascaran, in Peru, which had been stated by an American mountaineer to be over 24,000 feet. The complete description of this expedition, with a detailed report of the survey carried out, has lately been published, and will be interesting and useful to others who may be engaged upon similar surveys.

The work was undertaken by the Société Générale d'Etudes et de Travaux Topographiques of Paris, and placed in charge of M. E. de Larminat, the well-known topographical surveyor, who, with his nephew and M. René Loiseau as assistants, left Cherbourg on July 7, 1909, for South America.

After calling at Callao, the party finally arrived at Casma, a small port on the coast of Peru, on August 13, from which place Mount Huascaran lies roughly east, at a distance of about 60 miles.

* 'Détermination de l'Altitude du Mont Huascaran' (Andes du Perou). Exécutée en 1909 sur la demande de Madame F. Bullock-Workman, par la Société Générale d'Études et de Travaux Topographiques. Compte rendu de la Mission. Paris: Maison Andriveau-Goujon. Henry Barrière, Editeur. 1911.

The task M. de Larminat's party had before them was that of obtaining as accurately as possible in the time at their disposal the altitude of the various peaks of Mount Huascaran above the sea-level at Casma, and, with this object in view, the expedition left that place and travelled for about 45 miles to the valley of the Rio Santa, in the Black Cordillera. Here, on a suitable ridge immediately to the west of this river, and from which the various peaks of Huascaran and that of Huandoy are visible, a base line was measured with an invar tape. From the two ends of this base horizontal and vertical theodolite angles were observed to the peaks, and to other points, for the extension of the triangulation. The mean lengths of the base, which ran roughly in a northern and southern direction, was 1606·56 metres (5270·95 feet), and the height of the two terminal points 3780 and 3795 metres (12,401·8 and 12,451 feet). The base was measured twice, with a difference of only 0·0593 metres in the resulting lengths. The computation of this triangulation is most systematically and clearly set forth in tabular form in the present report, and it is evident that it was carried out with great care, and with most satisfactory results as regards accuracy. In the computations of the altitudes the coefficient for refraction was taken as 0·05. The question of refraction has been discussed by M. Henri Vallot in a chapter on the estimation of the precision obtained, and it is clear that any uncertainty in this coefficient can have no very serious effect on the resulting altitudes, as the total correction for refraction only amounts to about 3 metres. This is due in great measure to the exceptional favourable atmospheric conditions at the altitudes from which the vertical angles were observed, as well as the comparatively short distances of the peaks. The horizontal triangulation and vertical angles, of course, give the altitude from the points of observation only, and to obtain their absolute measures it was necessary to determine accurately the altitudes of these stations themselves. For this purpose a traverse and line of levels was run for a distance of about 44 miles from Garganta, one of the triangulation stations, at an altitude of 4616 metres (15,144·6 feet), down to the Pacific ocean at Casma, by way of Chaïapa, Quilto, Huanchuy, and Buenavista. The greater part of this work was carried on by means of a Brosset tacheometre, which seems to have given satisfaction until it broke down near the end of the journey, after which the Goulier "Boussole Nivelante" was used. This is also a form of tacheometre, and the results are, doubtless, fairly reliable, specially as two of these instruments were used by different members of the expedition, who worked independently, and obtained much the same results. Still it must be admitted that this part of the traverse is not likely to equal the other in accuracy; and, if time had allowed, it might perhaps have been well to have measured the angles of the traverse with the theodolite. Astronomical observations were taken for azimuth and magnetic declination, but for these the sun only seems to have been used.

During the sojourn of the party at Casma tidal observations were made to obtain a datum line for all the altitudes. For this purpose a provisional tide-gauge, or double-marked rod, was set up, and the height of the water noted at intervals of about six hours and ten minutes. About twelve of these observations were made altogether, with results that were considered satisfactory, specially as the observations were taken at a time of neap tide, and the amplitude of the tide at Casma is small. The altitude of point No. 231 of the traverse was thus found to be 2·8 metres (9·2 feet) above mean sea-level. For a really reliable value a much more extensive and complete series of observations would be necessary, so that this can only be considered

approximately correct, though perhaps the error would not be found to be great. The point where the traverse terminated is well marked, and should it be possible later on to obtain a more definite value for the mean sea-level, it will, of course, be quite easy to apply a constant correction to all the heights.

The final mean values for the heights of the peaks are as follows:—

	metres.	feet.
Huascaran, north	6650 ...	21,817·9
,, south, No. 1 peak	6763 ...	22,188·7
,, ,, No. 2 ,, ...	6737 ...	22,103·4
,, ,, No. 3 ,, ...	6418 ...	21,056·8
Huandoy	6354 ...	20,846·8
Yungay	2569 ...	8,428·6
Shashi-Punba	3318 ...	10,886·0

As regards the accuracy of these determinations, in the chapter dealing with this subject already referred to, M. Henri Vallot, after a careful discussion, comes to the conclusion that the probable error of the height obtained for the north summit of Huascaran is less than 6 metres, while that for the three peaks of the south summit is not more than 10 metres.

The report is throughout carefully prepared, and contains numerous maps, plans, diagrams, and sections.

ATLAS OF TERRESTRIAL RELIEF.*

Under the direction of Professors J. Brunhes, E. Chaix, and Emm. de Martonne, a specimen part of the 'Atlas Photographique des Formes du Relief Terrestre,' which has been looked forward to for some time, has just been issued. As is well known by geographers, the first suggestion from which this atlas has emanated was brought forward by Prof. E. Chaix in 1906; but his original idea was that the work should deal with erosion only, as advocated in his article on "Utilité d'un Atlas international de l'Erosion," which appeared in *Le Globe* (vol. **45**) for that year. Later on Prof. J. Brunhes joined Prof. E. Chaix in the enterprise, and at his suggestion several modifications were proposed; but still the work was to be limited to phenomena connected with erosion, and was to consist of only 150 plates, with very short notices. At the Ninth International Geographical Congress, which met at Geneva in 1909, the project was brought forward, and met with general approbation, but it was considered that the scope of the atlas should be enlarged, so as to exhibit, not only the effect of erosion on land-forms, but land-relief generally, and its causation. The extension of the original plan would necessarily increase the size of the work and entail a considerable amount of painstaking labour in collecting and arranging material; an international committee was therefore formed, consisting of representative physical geographers of all leading nations, and this now numbers twenty-eight. The actual preparation was placed in the hands of a small committee

* 'Atlas Photographique des Formes du Relief Terrestre.' Documents Morphologiques Caractéristiques, avec Notices Scientifiques. Publiés conformément à un vœu du IX^{e} Congrès International de Géographie sous les auspices d'une Commission internationale permanente, par J. Brunhes, E. Chaix, Emm. de Martonne, Editeurs. Frèd Boissonnas et Cie., Genève. Fascicule-Specimen.

consisting of the three gentlemen whose names have already been mentioned, while the execution of the photographic reproductions has been entrusted to M. Fréd. Boissonnas, of Geneva, who has already won a well-deserved reputation for work of this kind.

Judging from the specimen issue which has just appeared, the atlas promises to come fully up to expectations, and notwithstanding that this part has been somewhat hastily prepared that it might be ready for the Tenth Geographical Congress, which was to have met at Rome during the past autumn, it will be evident on inspection that the work cannot fail to be of great educational value, and must assist materially in geomorphological instruction. It is intended that in future the parts shall all be homogeneous in nature, and deal with one subject only; but in order to give a better general idea of its whole scope, the part just published is varied in character. It contains eight plans of beautifully executed photographic reproductions, on thick paper, each of which illustrates in a striking manner some type of land formation or erosive action, and is accompanied by a double page of text, with sketch-maps, diagrams, etc., in explanation of the special phenomena represented.

The following are the titles of the plates in this part which will serve to give an idea of the general scope of the atlas. Plate I.: Le Grand-Combin, seen from Mont de la Gouille (Valais Alps). Forms due to mechanical disaggregation. Plate II.: Ravin de Théus, near Gap (Hautes-Alpes). Elementary forms of erosion by running water. Plate III.: Cevennes. Cevenol plateau, on the watershed between the Allier and Borne. 1, Senile forms of fluvial erosion (peneplain), with commencement of rejuvenation; 2, Cevennes near Valgorge. Mediterranean slope of the central French massif. Rejuvenation of senile forms by fluvial erosion. Peneplain carved in crests. Plate IV.: 1, Sungaria. Lower valley of the Darbuti river. Fault valley. 2, The dead plain of Wildstrubal (Oberland). Example of fault worn by subsequent erosive action. Plate V.: James Peak, Front Range, Rocky Mountains. Senile forms rejuvenated by glacier action. Plate VI.: The Stockhorn, Bernese Alps. An example of ancient glacial erosion. Plate VII.: The Erg, seen from Taghit—contact of *erg* and *hammâda* (Algerian Sahara). Complex desert forms. Plate VIII.: Cliffs of Pays de Caux and St. Jean de Luz. Elementary forms of littoral erosion.

Naturally, a work of this kind cannot be carried out without considerable expense, and although many geographers, geographical societies, and educational establishments are already down on the list of subscribers, more are required to bring it to a successful termination. It is necessary that there should be at least two hundred subscribers, and it is greatly to be hoped that all interested will give the work their hearty support by doing all in their power to obtain additional subscribers, and so prevent it from falling through. A maximum number of 48 plates, with explanatory text, will, if possible, appear each year, and the annual subscription for this number is 30 francs. Should it be preferred, subscription need only be paid for one year in advance.

That this atlas may be a success, the executive committee also ask for photographs suitable for their purpose, and doubtless many will gladly respond to this request.

REVIEWS.

EUROPE.

Survey of the French Alps.

'Description géométrique des Alpes françaises.' Tome 1. Chaine méridional de Savoie. Paul Helbronner. Paris: Gauthier-Villars. 1910.

This is the first volume of an account of the geodetic survey of the elevated region of the French Alps from the Lake of Geneva to the Mediterranean, followed by a detailed survey of the area by photographic methods. The final result of the whole work will therefore be a complete description, "geometric and artistic," of this mountain district. The portion of the work included in the present volume was executed, as to the field operations, in 1907–8, and involved the occupation of twenty-eight stations over an area of 4000 square kilometres, say, one station per 50 square miles. This gives a satisfactory density of observation points, and should finally result in the fixation of all the mountain summits, whether accessible or inaccessible, with a degree of accuracy that must prove of prime value to the future student of the earth-movements in this region.

The technical details present no particular points of interest. No base was measured, the system being only tied on to previous triangulation stations. The theodolite used for the angular measurements was a somewhat old-fashioned vernier instrument weighing, in the two travelling cases, over 100 lbs. The large number of readings at each station, and the rigorous reduction of the polygons doubtless ensures a fair standard of precision in the final figures, but it would seem that similar results could have been attained with considerably less labour if a modern micrometer theodolite had been used. The choice of instrument was, however, limited by the burdensome restriction that it was considered imperative to use the centesimal division of the circle. This and the fact that no general discussion of the triangular errors is given renders it impossible, without great labour, to estimate the actual precision of the network, as compared with other similar surveys, but it would appear that the mean error of a ray in azimuth is about half a second of arc.

The discussion of the altitudes is reserved for a subsequent volume. The latter part of the book consists of a series of panoramic photographs taken from the triangulation points effectively reproduced in black and white.

E. H. H.

'Peaks and Pleasant Pastures.' By Claud Schuster. (Oxford: Clarendon Press. 1911. *Sketch-maps.* 7*s.* 6*d. net.*) A volume of climbing reminiscences, made up to a large extent of papers read to the Alpine Club. The author aspires "to cease to be an automatic machine for walking up hills and become a traveller," but his pages are devoted mainly to the incidents of mountaineering in the Alps.

'The Magic of Spain.' By A. F. G. Bell. (London: Lane. 1912 [1911]. Pp. xiv., 264. 5*s.*) The author calls his volume "a collection of stray notes"; at least they are pleasantly readable. They deal in great part with Spanish literature. But there are also studies of the Spanish character, notes of travel, descriptions of characteristic scenery (such as Andalusia in early spring), and a chapter on the Basques. Some of the notes relating to travel and the like may tempt the reader to ask where the magic comes in, but that is a question of temperament.

'Sport on the Rivieras.' Edited by E. Reynolds-Ball and C. A. Payton.

(London: Reynolds-Ball's Guides. 1911. Pp. xvi., 240. *Map and Illustrations.* 3*s.* 6*d.*) This is a compilation from various sources of information, dealing with the facilities for golf, lawn tennis, motoring, cycling, and other sports, and with freshwater and sea-fishing. Contributions have been gathered from various authors, and in some cases the apparently unedited publication of their rough notes makes rather difficult reading. The numerous if rather hazardous opportunities for trout-fishing will probably surprise many anglers.

'Turkey and the Turks.' By Z. Duckett Ferriman. (London: Mills & Boon. 1911. Pp. ix., 334. *Illustrations.* 10*s.* 6*d.*) This book is almost wholly devoted to an account of Turkish life and customs; in fact, the name of the country is barely appropriate in the title. But an interesting little study of the effect of geographical position on national development will be found at page 50. Incidentally there is in the first chapter a curious illustration and explanation of a page from an almanac designed for use in Turkish, Bulgarian, Greek, Armenian, and Jewish, with the different dates which are used side by side.

'Undiscovered Russia.' By Stephen Graham. (London: J. Lane. 1912 [1911]. 12*s.* 6*d. net.*) This, Mr. Graham's second book on Russia, is the record of an itinerary from Archangel to Moscow by the Dwina valley and Yaroslav, through the forest belt. The author lived the life of the peasant, as far as an Englishman well could; and his pictures of peasant life are not only charmingly written, but also full of insight and sympathy. Such a book is novel, and is to be welcomed. A good point, as regards the format of the volume, is that the illustrations are actually bound in, a practice one would gladly see more generally adopted.

ASIA.

Bokhara.

'The Emir of Bokhara and his Country: Journeys and Studies in Bokhara (with a Chapter on my Voyage on the Amu Darya to Khiva).' By O. Olufsen. Copenhagen: Gyldendalske Boghandel; London: Heineman. 1911. Size 10 × 7. *Map and Illustrations.* 21*s. net.*

This volume, describing a country which the author visited during the years 1896-99, would ordinarily be considered belated; the more so, perhaps, because in 1904 he published "Through the Unknown Pamirs," in which attention is confined to the provinces Wakhān and Garān, but which is based on the same expeditions. Yet, so far as the present writer knows, the information now given has not been recorded by any English traveller during the past fifteen years, and the book is therefore a useful and interesting addition to our knowledge of a strange land.

Bokhara, though in many respects enjoying home rule, is, as all know, virtually subject to Russia, and this mainly accounts for the absence of English explorers. Lieut. Olufsen suffered from no disability of this sort, and though not always actively assisted, he had the consent and general recognition of the Russian Government.

The country, though in parts desert, sparsely inhabited, and inhospitable, is full of historical and geographical interest; for these the river Oxus alone would suffice. At Kelif, on the road from Bokhara i-sharīf to Balkh and Mazār i-sharīf, the armies of Jengis Khan, Timūr, and Nādir crossed, and where these have gone others may come. Again, the Oxus is the boundary between Afghanistan and Bokhara, which state extends to the Pamirs, and so is near the sources of that great river. In his present book Prof. Olufsen, treating his former one as a supplement, begins his geographical description practically where the rivers Shakhdarra and Gund, having united, pour their contents into the Panja. Here he stayed for a

considerable time at a place called Khorok, and therefore should be able to set at rest Prof. Paquier's doubt mentioned in the footnote, Yule's Marco Polo, edited by Cordier, vol. 1, p. 172. Proceeding northwards, he takes the tributaries on the right bank in succession, and rounding the great bend at the foot of the Darwāz hills, he supplies much information. To do this methodically he divides the country into three main parts, Mountain Bokhara, Steppe Bokhara, and Desert Bokhara or Kizil Kum; these are subdivided, and each is treated in considerable detail. It must suffice to say that the geography, flora and fauna, people, buildings, communications, agriculture, religion, and even dress are all dealt with as well as may be expected.

The professor warns us that though he spoke Russian and Usbegic, he had to employ interpreters for the Tājik language. Traces that his knowledge of Persian is not equal to his acquaintance with Turkish are not wanting, nor can transliteration based on hearing fail to mislead; thus we find "tjillem" for the common word "chilham," part of a hookah, and "Tokele-tjokt" has so far defeated us, though the last part of the word suggests "ta*kht*" = a throne or seat. Apparently, too, there is some confusion about the derivation of Zarafshān mentioned on p. 141, as "Serafshan (the gold strewer, saraf = exchanger)." This is near enough to show the author's care, but the words really are "Zar" = gold, "afshān" = scattering or sprinkling; combined they are applied to rivers in whose sands gold is found. Ṣarrāf, whence the word "shroff," a banker, is Arabic and spelt with a different *ṣ*.

Another well-known Zarafshān is the part of the Yarkand river in the hills above the town of that name, which was recently visited by Lieut. Etherton, who travelled by the Mintaka pass, and recorded his experience in 'Across the Roof of the World' (Constable, 1911).

The want of efficient correction, the use of a foreign system of transliteration, metric tables, etc., make the book difficult to read; but that must not for a moment bias Englishmen against its merits, which are many and great, but cannot be done justice to in the available space. It is an excellent account of a remote and little-known country.

W. Broadfoot.

Armenia.

'Durch Armenien. Eine Wanderung, und der Zug Xenophons bis zum Schwarzen Meere.' By E. v. Hoffmeister, General-Lieut, z.D. Leipzig: B. G. Teubner. 1911. 8*m*.

This book is the record of a distinguished German general travelling along one of the historic routes of Asiatic Turkey, through the fortresses of Kars and Erzerum to the Black sea at Trebizond, containing nothing new in the way of modern travel, but traversing a route hallowed by tradition, and followed by many invading armies through this gateway into Asia Minor.

The book is specially to be commended as a work of military geography, in which the writer devotes his talents to describing the theatre of operations of the Russo-Turkish war of 1878, a district possibly to be again a contested field.

Passing through Southern Russia and the Caucasus, the author reached Kars, from which he turned aside to visit the battlefields east of the town, where for many months Mukhtar Pasha contended against the Russians under Loris Melikoff. On the fateful day of Kizel Tepe, August 25, 1878, Mukhtar Pasha, if he had displayed more energy and tenacity in his attack, could have broken the Russian centre, and possibly driven the Russians from the Caucasus, but "Kismet" ruled it otherwise.

The offensive movement lacked strength, possibly owing to the fatal

attraction of the fortress of Kars, and from that day onward the Turks were destined to be driven back under the walls of Erzerum.

Passing from the battlefields, the author devotes an interesting chapter to the ruins of the Armenian city of Ani, and then pushes across the Turkish frontier to Erzerum. There are many interesting military notes on this historic route from Kars to Erzerum. The traveller does not fail to notice that in drawing the frontier after the war of 1878 the Russians took care to occupy all the crests of the Soghanli Dagh which overlook the way onward towards Erzerum, and then he describes the further battles on the Deveboyun pass covering Erzerum. The description of the fortress of Erzerum, with its dreary treeless aspect of houses and streets in various shades of black and grey, is exceptionally accurate, and further it would be well for the student of political and military geography to note the author's remarks on the unique importance of the place as the gateway of Eastern Turkey, and as the strategic point through which all roads lead westwards towards Anatolia, even to Stambul itself.

Going westward, the traveller describes the minor fortress of Baiburt, the principal features of the Trebizond road, and also the beautiful Greek monastery of Sumela nestling against the face of a steep crag, as the photograph in the frontispiece and others of this picturesque spot show; after which the old capital of the fleeting empire of Trebizond is well described.

General Hoffmeister's scheme of descriptive writing is specially to be commended to those intending to write a book of travel. The history of the districts passed through is sketched, with notes on the various races, such as Kurds, Armenians, Greeks, and others, while the reader's interest is heightened by numerous small inset photographs depicting wayside incidents, all of great value in aiding the reader to understand the country. One slight criticism may be made on p. 84, as the photograph there is surely not that of a Kurdish chief of Alashgird, but rather of a worthy Armenian in the Kurdish dress of Jezire-ibn-Omar, far to the south.

A second part of the book deals with the march of Xenophon and his Ten Thousand through Asia Minor, and their retreat north to the Black sea, which are discussed with thoroughness and detail. General Hoffmeister strove hard to reach the precise spot where Xenophon's weary soldiers at last came to view the Black sea and raise the welcome shout of "Thalassa, Thalassa!" but it is not to be found on the route over the Zigana pass, but rather on the summit of the Kolat Dagh farther east, a point inaccessible from the snow at the time the general passed.

The book forms a companion volume to the same author's book called 'Kairo—Baghdad—Konstantinopel,' also a well-ordered and interesting book of travel, profusely illustrated with photographs, both small and great, to aid the reader. Among these some charming photographs show that the gallant general is not entirely insensible to the feminine charm of the Orient.

F. R. M.

AFRICA.

The Baganda.

'The Baganda.' By the Rev. John Roscoe. London: Macmillan & Co. 1911. 15*s*.

The author of this book, Mr. Roscoe, who, for his services to ethnology, has been made an honorary M.A. of Cambridge, and is now an anthropological lecturer there, was for many years a member of the Church Missionary Society in Uganda, and some fifteen years ago began to make himself noteworthy as an accurate recorder of negro manners and customs in this most interesting part of Africa, where so many negro races and tribes conjoin. From the point of view

of the student of African anthropology and ethnology, there is probably no more interesting dominion in which to settle and study than the Uganda Protectorate, for it gives us examples of nearly all the leading African types except the Bushman and the Berber. There are within its limits or just across its borders (and entering the Protectorate for purposes of trade or service) the Pigmies of the Congo forest, and the closely related dwarfish people of the Chagwe forest in the heart of Uganda; the aristocratic Hima caste, with what Mr. Roscoe calls "Roman" noses, with light complexions, and hair that is finer, silkier, and less tightly curled than the hair of the pure-blood negro. There are the giant, naked, long-legged Nilotic peoples on the north and east; a great variety of Sudanese types; tribes of Masai affinities in the Elgon district; and, lastly, a large proportion that is typically Bantu in language and physical conformation. (The Bantu type in the last particular being nothing but a more or less perfect blending of the long-legged Nilotic and the short-legged Forest negro.) Within the limits of this Protectorate we have probably the most archaic and the most profoundly interesting of the Bantu languages.

The Baganda people—though, as Mr. Roscoe points out, of very varied physical type, some being Hima with Egyptian profiles, others Nilotic, others hideously negro or semi-pigmy, or just stalwart (I would add, Zulu-like) Bantu—offer a remarkable blending of East and West, North and South Africa, in their manners and customs, their religious beliefs, their industries and folk-lore. Particularly interesting among them is the development of the totem clans, of which a description in this book is given far more amply and much more accurate than that hitherto supplied by any other writer on Uganda. This information is supplemented in an appendix by anthropometric tables of great fulness, applied to persons selected from most of the clans. This, if analyzed by some such anthropologist as Dr. F. C. Shrubsall, should perhaps throw some light on the question of whether these totems indicate originally the families derived from foreign immigrants of superior strength or culture, or whether some of them may be pariahs of aboriginal race. Mr. Roscoe seems to think that the members of a clan exhibit a distinct family likeness to each other.

In many of its aspects this book is more suited for review in the *Journal* of the Royal Anthropological Institute, but it possesses a high geographical interest, and must therefore come within the purview of the Royal Geographical Society, to whose Fellows it is strongly recommended by the reviewer as the most complete and the most accurate description of the Baganda which has yet appeared; premising that it deals (after a general survey of the country) almost exclusively with the *Baganda*, with the people, that is to say, of mixed negro origin who speak the Luganda language.

H. H. JOHNSTON.

THE TANGANYIKA PLATEAU.

'The Great Plateau of Northern Rhodesia,' etc. By Cullen Gouldsbury, B.S.A.C.A., and Hubert Sheane, F.R.A.I., F.R.G.S., B.S.A.C.A., with an Introduction by Sir Alfred Sharpe, K.C.M.G., C.B. London: Edwin Arnold. 1911. 16*s*.

The official name of this book is a little misleading, as it may suggest to those who scan the titles of geographical works that it deals with the other great plateau of Northern Rhodesia, that which contains the headwaters (west and south of the Luapula) of the Kafue, and of the Lusenfwa. Its most correct designation would be that of its sub-title, 'The Tanganyika Plateau.' This book, however, is the best account which has yet been written of the Awemba people—their history and legends, folk-lore, laws, religious beliefs, birth, initiation, marriage, divorce, and death customs, their social life, arts and industries,

husbandry and hunting customs. It also gives some account of their physique. In addition, it deals most interestingly with the effect of the white man's arrival on the scene, with the life of the white man—official, trader, and missionary—in their midst, with mission work in general and its results, with the scenery and products of the Tanganyika plateau, its future prospects in relation to world commerce, its animal life, especially in regard to the elephant. The scenery of this region, besides being described here and there in the text, is aptly and charmingly illustrated by excellent photographs, from which those who have not visited this region will realize its attractiveness to the eye, and its episodes of real beauty, fit to be placed alongside the fine scenery in Natal, in Basutoland, Southern Rhodesia, Nyasaland, Uganda, East Africa, and the eastern parts of the Congo basin. It is a book of very great merit, which will occupy as authoritative a place in regard to the Awemba people as that of Mr. Roscoe will in connection with the Baganda.

H. H. JOHNSTON.

THE RACIAL PROBLEM IN SOUTH AFRICA.

'Black and White in South-East Africa.' By Maurice S. Evans, C.M.G. With a preface by Sir Matthew Nathan. (London: Longmans, Green & Co. 1911.) *Map.* 6*s. net.*

This is a book which, in the words of Sir Mathew Nathan, "attempts to come to grips with the difficulties of a vastly important subject," namely, the future of the black and white races in South-East Africa. The author writes with authority borne of close study of the question, and with experience gained by thirty-seven years' residence in the land. We cannot here enter into a critical examination or analysis of his statements and reasoning. A broad indication of Mr. Evans' conclusions must suffice, together with a strong recommendation of the book to those interested in the future of South Africa, especially to South Africans themselves, though all will not find it palatable reading.

Mr. Evans, a Natalian, proceeding on a sound geographical basis, defines South-East Africa, for his purpose (see his map), as consisting of the Transkei Territories, Natal, Zululand, Basutoland, and the Transvaal, with the eastern corner of the Orange Free State. These are the parts of British South Africa where the native population is at once most dense and (save in Basutoland) least progressive. Nor in these regions is there any considerable mixed race, like the familiar "Cape boy." Mr. Evans is not concerned merely with the native problem; he perceives that the white problem is equally important and exigent, and the solution—miscegenation—which the "Cape boy" may stand to indicate is, of all possible solutions, the one to him most abhorrent. He believes, and Sir Matthew Nathan leans to the same view, that for the well-being both of the black and the white the two races should be kept apart. Put very briefly, Mr. Evans favours what one may call the Basutoland plan. In Basutoland white settlement is virtually prohibited; the Basuto enjoy autonomy and are free to develop on their own lines. Repeat this plan, says Mr. Evans in effect, all over South-East Africa, give the natives ample reserves, let them have local self-government, and progress upon Bantu and not upon European lines; the present contact between Kaffir and Europeans is bad for both races. There is much force in the contention; much more force than white South Africans are willing to acknowledge. Both Mr. Evans and Sir Matthew Nathan seem to answer the query of the Hebrew prophet in the affirmative, with the qualification that in the process both whites and blacks will suffer deterioration.

FRANK R. CANA.

'Congo Life and Folk-Lore.' By the Rev. John H. Weeks. (London: Religious Tract Society. 1911. *Illustrations.* 5*s. net.*) Mr. Weeks, a Baptist missionary possessing an intimate acquaintance with a considerable area of the Congo basin, divides his book into two parts. The first is a description of the Congo peoples from the native standpoint; the second part consists of thirty-three native stories—mostly about animals—and many of them quite fascinating. This part of the book, separately printed, should prove highly popular with young people. It has also a serious interest for students of folk-lore. How far in Part I. Mr. Weeks has pierced into the recesses of the native mind it is difficult to judge, but he has certainly given an accurate picture of daily life on the Congo. The purpose of Part I. is incidentally to illustrate the difficulties Christianity has to encounter from the moral atmosphere of the country. What the missionaries have accomplished in domains other than the purely spiritual is only lightly touched upon, but Mr. Weeks himself affords an example of what the science of anthropology owes to men of his cloth.

'South Africa To-day. With an account of Modern Rhodesia.' By H. Hamilton Fyfe. (London: Eveleigh Nash. 1911. *Illustrations.* 10*s.* 6*d. net.*) Mr. Fyfe was in South Africa when the Union was established, and in the train of the Duke of Connaught saw a good deal of the country. A careful observer, confident in judgment (sometimes too dogmatic on difficult questions, such as that of the relations between black and white), with a facile pen, and an engrossing subject, Mr. Fyfe has turned out a very readable book which may be trusted as giving a generally accurate impression of South Africa. Rhodesian life is depicted with particular care and skill.

'Gold Coast Palaver.' By L. P. Bowler. (London: Long. 1911. Pp. 173. 2*s.*) This title suggests a certain unnecessary modesty, for it conceals a useful collection of facts, based on the experience of eight years' residence in the colony. The writer's chief interest lies in mining, the possibilities of which are dealt with at length; but other industries are not overlooked, and stories of the natives and short chapters on entomology, flora, and health precautions are among other features. The writer insists upon the urgency of extending the railway beyond Kumasi, and in dealing with the "native problem" he enters into the controversy with no uncertain voice.

'The Story of Ancient Egypt.' By Robinson Souttar. (London: Hodder & Stoughton. *N.d.* Pp. 249. 1*s.*) A short and clearly written history of Egypt from the earliest period to that of the Roman provinces. The Hebrews, Phœnicia, and Carthage are also dealt with. Covering so wide a field, the text is hardly to be criticized for omissions, but it may be suggested that an index might have been admitted.

AMERICA.

'In the Guiana Forest.' By J. Rodway. (London: Fisher Unwin. 2nd edit. 1911. Pp. 326. *Illustrations.* 7*s.* 6*d.*) A second edition of this book has been issued with an avowed special appeal to teachers, "as Nature study has now become an important part" of education. The geographical student and the Nature student have so much in common that the former should also welcome this book. For it may be read not merely as a description of life in the forests of Guiana, but as an illustration of the conditions of life in any tropical forest. It is laid out with that view. It describes the native in his *rôle* of patriarch, hunter, and fisherman. It describes the animal and insect and floral life, always with those natural laws in view which govern the existence, distribution, and propagation of genera and species. We also find the different physical divisions of the forest analyzed—the uplands, the rivers and creeks,

the swamps, and the seashore. The book possesses much of the method of a true geographical study.

AUSTRALASIA AND PACIFIC ISLANDS.

'The King's Caravan: Across Australia in a Wagon.' By E. J. Brady. (London: Arnold. 1911. Pp. x., 339. *Maps and Illustrations.* 12*s.* 6*d.*) The writer made a lengthy sojourn in tropical Australia, and narrates his experiences in an entertaining manner. We gather from the book some inner details of the life of the mining, farming, and trading community in Queensland.

'New Zealand.' (Cambridge Manuals of Science and Literature.) By the Hon. Sir R. Stout and J. Logan Stout. (Cambridge: University Press. 1911. Pp. 185. *Illustrations.* 1*s.*) This well-written little book contains little in the way of description of the country with which it deals, but covers a great deal of ground in the direction of economic conditions, government, and administration, etc. It appears rather isolated in the imposing list of the series published or in preparation, as the only volume of its type, but New Zealand is much less liberally treated than other great dominions in literature of this sort.

'The Piraki Log.' Ed. by F. A. Anson. (Oxford: University Press. [1911.] Pp. 171. *Maps and Illustrations.* 6*s.*) This log, extending from 1836 to 1844, is that of a whaler and trader at Piraki, which is situated about midway on the east coast of South Island, New Zealand. It is accompanied by an introduction, a glossary, and certain kindred documents. It forms an instructive relic of the earliest days of British activity in New Zealand, and among other interesting points the editor shows how the illiterate phonetic spelling of native names gives a clue to their pronunciation at the period.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Climatic Control.

'Climatic Control.' By L. C. W. Bonacina. Black's School Geography. London: A. & C. Black. 1911. *Illustrations.* Pp. 167. 2*s.*

The main standpoint indicated by the suggestive title of this little book is kept well to the fore throughout; after a first short chapter given to general principles of climatology, we are at once introduced to the climatic control of vegetation; then come descriptions of the vegetation and scenery of well-known lands; the British Islands are treated in a masterly way, this being perhaps the best part of a generally good book; Russia, Italy, Egypt, India, Brazil, and Greenland are well chosen to represent other types of climate, and are for the most part well described. The rest of the book deals with the direct influence of climate on man; climatic control in what we may call minor matters, such as the arrangements of houses inside and out, clothes, industries, sports, in different parts of the world, is presented in an interesting way. The treatment, however, of the wider problems of the psychological and physiological effects, direct and indirect, of climate is rather disappointing, and the conclusions are not always convincing.

Some of the maps might be improved, notably that showing the vegetation zones of the world. The figure on p. 18 might be better. All teachers know that a picture produces far more impression on the average pupil than many words, hence the importance that the impression produced be as correct as possible. In this figure the relative sizes of Sun and Earth, the distance between these bodies, and the ellipticity of the Earth's orbit, give a false idea, intensified by the fact that the continents are drawn on the Earth on a correct scale.

In several places in the book the thermal theory of differences of atmospheric

pressure is referred to, but nowhere satisfactorily explained. "Expanded air, consequently lowered pressure," "air sucked in," are loose statements of the facts observed, and it is unfortunate that it should be implied that the mere fact of the expansion of the air is the cause of lowered pressure at the Earth's surface; it is rather the overflow in the upper air, a phenomenon hardly, if at all, referred to, which is the direct cause of the decrease in pressure. The phenomenon of decrease in temperature with increase in altitude deserves fuller treatment than it receives.

Such flaws, however, might easily be removed; the mere fact of the appearance of a book entitled 'Climatic Control' is an indication of the more educational study of geography now coming into vogue, and on the whole this book is decidedly above the standard of most school books on the subject.

W. G. K.

GENERAL.

Two Text-books of Commercial Geography.

'Commercial Geography.' By Prof. A. P. Brigham. London: Ginn & Co. 1911. 6*s*.
'Commercial Geography.' By J. F. Unstead and E. G. Taylor. London: G. Philip & Son. 1911. 2*s*. 6*d*.

Though the preface of the first book speaks of it as "an elementary text," it is not clear for whom it is really intended. Part I. deals—nominally from the general, but mainly from the "American," point of view—with five important world products, and then professes to deduce from the previous five chapters "the Principles of Commercial Geography." Part II. deals specifically with the U.S.A.—in 176 pages, *i.e.* $\frac{11}{25}$ of the whole book. If the book is intended for really junior students, this treatment and selection of material are appropriate; but for such students much of the book is difficult, and the price is excessive. If it is intended for any but juniors, neither the method nor the limitation of interest and outlook is appropriate, though there may be some excuse for the over-emphasis of the purely economic.

As to details, in Part I. the choice of products (wheat, cotton, cattle, iron, coal) is excellent, but the treatment is disappointing, especially as Prof. Brigham is the last person in America whom we expected to find over-emphasising the purely economic at the expense of the essentially geographical. Chapter VI. does not deal with "the Principles of Commercial Geography" as usually understood; still less does it deduce them from the data already given. By "principles" Prof. Brigham means simply classified subject-matter, and the deduction is simply a correlated summary of the data.

Except for the chapter on "Transport," all Part II.—like the numerous sections of Part I. that refer to U.S.A.—is really valuable, and the chapters on "The Concentration of Industries" and "Centres of General Industry" are characteristically delightful. There, especially in the former, Prof. Brigham is himself again, the author of "Geographic Influences"—human, satisfying, suggestive.

The rest of the book is slight, and suffers from over-rigidity of mental attitude. Surely in dealing with foreign areas it is peculiarly important to adopt an attitude appropriate to the particular area, *i.e.* having definite relation to the dominant note of the area. The right attitude towards, *e.g.* Canada, should be based, not on the actual economic importance of the area to-day, but on its essential geographic possibilities.

The book has the great merit of absolute honesty. Except for a curious

statement (? misprint) on p. 203 about "*artificial* moisture being preferred in U.S.A. textile mills," no disputable "fact" is introduced, and no strained interpretation is put on any indisputable one. Except, again, for the representation of canals by the chequered lines usually reserved for railways, the book is well illustrated, and it is very readable.

The chief merit of the second book is that it certainly attempts to base the commercial phenomena on the physical geography; but its claim to cater for "examination candidates" and to supply them with "explanations" and "mental pictures" is far from justified. It is not obvious how the excessive analysis employed is going to favour such a synthetic process as the building up of a mental picture, even if the explanations were always—or even often—really explanatory, and the statements were above suspicion. For "examination candidates" the general statements of Part II. would carry more conviction and be more useful if specific instances were reasonably numerous and not hackneyed; and some of these statements are unquestionably misleading, if not absolutely incorrect. In the sections referring to, *e.g.* cotton (pp. 46, 48), we learn that "notwithstanding its name, the greatest production of sea-island cotton is not along the sea-coast, but some distance inland," and "the Egyptian cotton area has but little rainfall, for the crop is a summer one." The average examination candidate would infer that the *finest* kind of cotton was not grown on the sea-islands (of John, James, Edisto, etc.) of South Carolina, and that Egypt had an appreciable *winter* rainfall—both inferences equally absurd. Coal receives the same kind of attention on pp. 155 and 163. In the one case it is said to be "widely distributed" in the Balkan States—which is not true even of lignite, still less even of decent Tertiary lignite—and in the other to exist "in every province of China Proper," a statement which no examiner would accept in place of some specific reference to the Kaiping basin or Shansi anthracite, etc. Even with regard to the best-known areas the information is similarly unsatisfactory, as in the case of the U.S.A. cotton above; and some of the other statements about the U.S.A. are absolutely misleading. For instance (p. 187), the fruit areas are said to be three—north-east, extreme south and California; and the special products of the South are stated as "oranges, lemons, and pine-apples," whereas actually lemons are of no importance except in California. So, on p. 191, it is stated that "one-sixth of the U.S.A. cotton goes to New England, where the water-power enables it to be manufactured cheaply." No ordinary examination candidate would infer from this—what is actually the case—that the better water-power in the south-east is precisely one of the chief causes which are drawing the cotton industry away from New England. Indeed, New England has gone so much beyond her water-power (and so must rely on coal) that by 1907 North Carolina had 276 cotton mills against 204 in Massachusetts. Under the Argentine (p. 202), twenty *words* deal with *wheat and maize*, and even this is only incidental to railways and exports. This would scarcely give a good "mental picture" or even a profitable answer in examination.

Wheat and its Cultivation.

'Wheat-growing: in Canada, U.S.A., and the Argentine.' By W. R. Rutter, M.A. A. & C. Black. 1911. 3*s.* 6*d.*

This book reflects credit on all concerned in its production—on the publishers for their spirit in taking up a book which, to a superficial glance, is distinctly unattractive—on the Geographical Department in the University of Manchester

where, obviously, an admirable training in geography is being given, and on the author for much patient and discriminating work. In spite of some unnecessary digressions, *e.g.* about the Panama canal, the book is essentially geographical. Indeed, no teacher of Commercial Geography in this country can afford to do without it; and most will probably be glad of the digressions. And the Canadian Government might find many worse ways of spending money than in presenting a copy to every holder of a quarter-section on the prairie—where the book might quite conceivably be worth to them a bushel an acre.

In view of a speedy reprint, attention may be drawn to some points of omission, or insufficient emphasis on essentials, or alternative interpretation of facts. For instance, there is little or no emphasis laid either on the beneficial influence of cool nights on the quality of the Canadian grain, or on the direct control exercised by the short spring on the general character of the work and the order of doing it on a Canadian quarter-section. Again, the space devoted to "grain speculation" might well have been devoted to a clearer and longer analysis of the paramount necessity for "Fall" ploughing; and, in connection with "Fall" work, it is snow rather than frost (p. 136) that facilitates transport. There is a slight confusion between the influence of the different kinds of sun-ray; it is essentially the ultra-violet, not the yellow or red, ray that is excluded by the humid "blanket." Similarly, the statement that in dry-farming "the harrowing is repeated after each rainfall," is slightly misleading; it is repeated on the first sign of consolidation, whether caused by rain or otherwise. Emphasis is, of course, rightly laid on the importance of "breed," but it should be made clear that this is essentially subordinate to—as it is ultimately a product of—the climatic control: the quite different behaviour of the same "breed" (Barletta) in north, central, and southern Argentina sufficiently proves this. The author's appreciation of the "certainty" brought into agriculture by irrigation ignores the evidence provided by the historic irrigation areas of the world as to the demoralization of the irrigators by such "certainty."

'My Climbing in Four Continents.' By S. Turner. (London: Fisher Unwin. 1911. Pp. xii., 283. *Illustrations.* 12*s.* 6*d.*) This author probably did his best work in Siberia, and about this he has written elsewhere. He has now produced a well-illustrated book on his climbing experiences generally, which show him to be as adventurous a traveller as climber. His qualifications in the latter respect are borne out by panegyrics contributed by friends to the volume, which furnish a complement to his own obvious delight in his pastime and his powers of pursuing it.

'The Changeful Earth.' By Grenville A. J. Cole. (London: Macmillan. 1911. Pp. ix., 223. *Illustrations.*) This little volume belongs to a series of "Readable Books in Natural Knowledge." It deals succinctly with the various natural causes of change on and beneath the Earth's surface, as, for example, running water, glaciers, volcanoes, earthquakes. It undoubtedly justifies the epithet bestowed on the series, being eminently readable and even fascinating. The author makes judicious use of the method of arresting attention to facts of general application by means of only a few illustrations worked out in high detail; thus the recent volcanic outbreaks in St. Vincent and Martinique are allowed no less than ten pages of vivid description.

'The Wanderings of Peoples' (Cambridge Manuals of Science and Literature). By A. C. Haddon. (Cambridge: University Press. 1911. Pp. vii., 124. *Map.* 1*s.*) It is no mean task to compress into the compass of this handbook a survey of the principal migrations of the inhabitants of the world. The book

will be found less easy to read through than to use for reference. For the latter purpose it is excellently adapted, being adequately indexed and accompanied by maps on which the lines of the principal movements are traced. The periods of all movements, known or supposed, are given with scrupulous care, and many suggestive reasons for the occurrence of migrations will be found.

'Papers on Inter-racial Problems.' Edited by G. Spiller. (London: King. 1011. Pp. xlvi., 485. 7*s.* 6*d.*) In this volume (which is notably light for its bulk) have been collected the papers communicated to the first Universal Races Congress, held in London last July. In the list of contributors are many names of very high standing. The collection, representing, as it does, opinions of almost every nationality on racial problems, possesses its geographical importance, although geographical considerations do not bulk largely in the papers; just as it possesses political importance, although political resolutions were excluded from the proceedings of the Congress.

'The Unoccupied Mission Fields of Africa and Asia.' By S. Zwemer. (New York: Student Volunteer Movement for Foreign Missions. 1911. Pp. xx., 260. *Maps and Illustrations.*) Mr. Zwemer is known to geographers chiefly through his journeys in Oman. He ranges much more widely in the present volume, though it is only in the first chapter that he analyses at all closely the geographical distribution of unoccupied fields for missionary work. For the rest he is concerned principally with general considerations as to the proper course and value of the work, and he strikingly compares the work of the missionary and the geographical explorer.

'The Sportsman's Handbook to Collecting, Preserving, and Setting-up Trophies and Specimens.' By Rowland Ward. (London: Ward. 4th edit. 1911. Pp. xxiii., 303. *Illustrations.* 3*s.* 6*d.*) For the present edition this valuable guide has been revised and enlarged, especially in the section dealing with the world's hunting-fields. This section has been under the care of Mr. R. Lydekker.

THE MONTHLY RECORD.

EUROPE.

Sedimentation in the Lunzer-Seen, Lower Austria.—For several years Dr. G. Götzinger has been engaged in a thorough study of the Lunzer-Seen in their various relations, cartographical, hydrographical, and physical. The material collected will be published at length in supplementary parts of the *Internationale Revue der . . . Hydrographie*, but an instalment, dealing in detail with the conditions of sedimentation in the lakes, has appeared in the *Verhandlungen der k.k. Geologischen Reichsanstalt*, 1911, No. 8. Of the three lakes, which are arranged stepwise in the Hirsch or Seebach valley, the paper is concerned only with the upper and lower, which occupy rock-basins ascribed to the ice of the Glacial period. The middle lake, which Dr. Götzinger has described elsewhere, is of a more complicated character, its original basin having been filled with *débris* since the retreat of the ice. The upper lake has an irregular floor, and has greatly diminished in area owing to the encroachment of moorland vegetation. The lower lake is a typical Alpine lake, and any decrease in area has been due to the transport of gravel and sand by the influent stream. This forms a typical delta, composed of stones and gravel falling at a steep angle. Of the three distinct forms of sedimentation, gravel, sand, and mud, the first is confined to this delta, and to a limited extent of the shore-line

while sand is almost entirely lacking, the gravel passing with hardly any graduation into the mud which covers by far the greatest part of the floor. The varying characters, mechanical and chemical, of the mud have been studied from samples taken during the sounding of the lake, and a map is given showing the distribution of the different forms. Dr. Götzinger considers these under the main headings of (1) shore-platform, or area of shallow water near the shore; (2) slope, by which the shore-platform falls steeply to (3) the "Schweb," or nearly level expanse of ooze which occupies the whole centre of the basin. The shore-platform is due to wave-action, and sedimentation takes place chiefly at its outer edge, where the lessening agitation of the water allows the coarser materials to be deposited, somewhat after the analogy of a delta, though gravel is here absent, and even sand occupies a subordinate place. The actual surface is formed, not of the shore detritus, but of an organic chalky ooze derived from the shells of molluscs and from algæ. The sediment on the lake-floor consists of the fine suspended matter brought in by the influent stream, and (to a much less extent) that derived from the disintegration of the shores. Dr. Gotzinger devotes much attention to this, tracing the method of formation of the characteristically level floor due to its deposit, the seasonal variations in the amount laid down, and so on. Being principally derived from the matter brought in by the Seebach, the rate of deposition naturally varies with the amount of water in the latter, and, as proved by experiment, is greatest in spring and summer, while it is reduced to a minimum in winter. Observations of transparency confirmed these facts, and showed also that the suspended material is precipitated with great rapidity in summer; the explanation being that the rise of temperature lessens the specific gravity of the water, the decrease being all the more rapid the warmer the water becomes. The chemical composition of the sediments varies greatly with the distance from the shores, that near the latter being rich in lime, but poor in oxides of silica, magnesia, iron, and alumina, while these oxides abound in the deposits of the floor. The upper lake shows marked contrasts with the lower, particularly in the predominance of organic over mineral matter held in suspension by the water.

ASIA.

Baron von Oppenheim's New Expedition to Mesopotamia.—Baron von Oppenheim, known for his researches in Asiatic Turkey in the nineties of last century, and his two-volume work, 'Vom Mittelmeer zum Persischen Golf,' in which they are described, last year undertook a new expedition, the first results of which are briefly mentioned in *Petermanns Mitteilungen* for December, 1911, p. 343. The traveller is unusually well equipped, and accompanied by various experts, so that, even on the fairly rapid march from Aleppo to the scene of the more detailed work, important observations of antiquities were made, though the effects of the extraordinarily severe winter of 1910–11, in which Aleppo was in the thrall of snow and ice for forty days, while whole herds of cattle and sheep were frozen to death, were unpleasantly felt. From the desert castle Kalaat en Nejm on the Euphrates, the little-known western bank of the river between that point and Meskene was followed, after which the expedition took the route on the east side, followed by Miss G. Lothian Bell in 1909, as far as the Khabur. The hitherto unvisited country east of this tributary was then traversed to Tell Halaf, near Ras el Ain, where a stay was made for excavation work. On the way a side trip was made to some mediæval remains on the right bank of the Khabur.

The Road from Hsining-fu (Sining) to Kanchou-fu.—At the end of the

present number will be found a map reduced from a route survey between these two places carried out in August and September, 1910, by Mr. O. R. Coales, during a journey across the Chinese Empire from east to west, through Sechuan, Kansu, and Eastern Turkestan. While making no claim to a high degree of accuracy, it may be useful in view of the scantiness of the cartographical *data* in respect of this stretch of country. Although the terminal points lie on well frequented routes, and have frequently been visited by travellers, the direct route between them is not often traversed, and apart from the route survey by Obrucheff in 1893, of which the only detailed account is in Russian, there is little available material. During Mr. Coales' march, distances were estimated from the average rate of progress and bearings taken by compass. Heights were determined by boiling-point thermometer and aneroid, the starting-point at Hsining being reckoned as 7506 feet above sea-level. Notes descriptive of the topography are entered upon the map, and are supplemented by the following additional particulars with regard to the places passed through, the true names of which were carefully ascertained, and are translated from the Chinese according to the Wade system. Ta-t'ung, or Mo-pai-shêng,* is a Hsien or magistrate's city subject to Hsining. It is a strong Mohammedan centre which escaped devastation during the rebellion of 1895 by a money payment. Pai-tai-t'ung is a small rectangular walled town with two streets at right angles, and probably not 1000 inhabitants. It was ruined during the rebellion, but the Chinese are said to be colonizing it. An interesting race, called T'u-yên by the Chinese, lives in the mountains to the south-east, and is said to differ alike from Mongols, Tibetans, and Mohammedans. Yung-an,† Opo, Yung-ku, Hung-shui, and Lupa are small walled towns, mostly under military officials, while Sha-chin is a camp of gold-miners, all Mohammedan Chinese, who dig out the gravel from the torrent beds and wash for gold. Agents from foreign firms at Tien-tsin come to Opo, Yung-an, and Pai-tai-t'ung to buy wool, which is exported *viâ* Kan-chou. Few Mohammedan Chinese are to be found north of the Nan-shan range. Mr. Coales kept a very complete meteorological journal, including barometer, thermometer, wind, rain, and boiling-point observations, during his whole journey, and a copy has been sent by him to the Society.

Caves in Southern China.—Dr. G. D. Thomson of Canton writes us an account of some caves in the south of the Kwang-tung province, which, he says, have never yet been described by a European traveller. They lie about 250 miles south-west of Canton, by the route followed by boat. This involves the descent of the Canton river to the sea, and a coasting voyage west to the mouth of the Yeung-Kong river, which is ascended to the city of the same name. Here it is necessary to change boats, taking a native craft, pulled or poled by native men and women when the wind is contrary. In this way the walled city of Yeung-chou is reached, and the caves are situated a mile or more to the west of it. The chief cave is of large size and very beautiful. The hills in the immediate neighbourhood rise abruptly from the plain in jagged rocky cliffs of totally different formation from the surrounding hills and mountains. At the entrance and on ledges high up the cliff there is a Buddhist monastery and

* The latter name is that adopted by Obrucheff, who, like other travellers, uses Ta-tung (Da-tun) for the town on the river of the same name called Pai-tai-t'ung by Mr. Coales.

† Yung-an was visited by Prjevalsky during his first expedition, his route crossing that of Mr. Coales in this neighbourhood. It appears to have been missed by Obrucheff.

shrines, presenting a gaudy appearance. From the outer chamber, which is beautified with stalactites and stalagmites, a flight of steps leads up to a second, cathedral-like cavern, not visible from the first. In this there is a stone table and stools, and shrines around the walls in niches, but the whole upper part is untouched by man. At the far end a passage lets in the daylight from the opposite side of the hill. Dr. Thomson proposes to call this group of limestone caves by the name of Lord Kinnaird, in gratitude for the kindness shown to him and his brother during their college days. He refers also to various other groups of caves in the same province, which make of this part of China a veritable cave country. Though they have been described by Dr. Henry in his book called 'Ling Nam,' they are far from being generally known. They include the "Cathedral cave" (so named by Dr. Noyes of Canton) and others to the north of that city on the Lien-chow and North rivers; and those in the neighbourhood of Shiu-hing on the north bank of the main Si-kiang or West river.

AFRICA.

Prof. Hans Meyer's East African Expedition, to which reference was made in the December number (vol. **38**, p. 625), was brought to a close at Dar-es-Salaam in November. A series of letters written *en route* and printed in the last number of the *Mitteilungen aus den Deutschen Schutzgebieten* (vol. **24**, No. 5) sketch the main results of the professor's observations in Ruanda, the region of Lakes Kivu and Tanganyika, and on the march from the latter to the coast. We left the traveller at the station of Kisali in Eastern Ruanda. From this point to the Kirunga volcanoes he traversed an interesting country in part previously unexplored, formed by the clay-slate mountain-system of Northern Ruanda. This old plateau is furrowed by longitudinal valleys running generally north and south, separated by steep ridges following the strike of the slate and quartzite. It culminates in a semicircle of mountains drained southwards, and rising in Mount Kabuji to an altitude of 2600 metres (8530 feet). The whole is a grassland with a surprising extent of terrace cultivation, the population being settled at the upper levels miles away from any water, the fetching of which is thus a work of great labour. Communications are good, though there is virtually no export of produce. This region falls northwards to the great lava-tract formed by the outpourings from the volcanoes. The lava must have been of a thin consistency, and it was dammed back by the Ruanda mountains, pushing up into the valleys open towards the north. Prof. Meyer's investigations among the volcanoes were to some extent hindered by rain and mist, though he ascended two—the highest, Karisimbi, and the now once more active Niragongo. He says that the trade of the Belgian territory near Lake Kivu is becoming more and more tapped by the English in Uganda, and he advocates the placing of a German vessel on the lake. He and his companions explored the islands of Kivu, the largest of which, he says, is properly named Ijwi, not Kwijwi. Its population seems to be increasing. On the way to Tanganyika the chief task was the exploration of the hitherto blank patch on the maps to the south-west of Isawi, especially the Muvisi range and highest part of the water-parting between Ruanda and the central trough. The range is not, as has been supposed, uninhabited, but is well peopled and cultivated, though southwards the people became more and more shy. The further route led over the Rusiga range to the source of the Ruvuvu, discovered by Baumann, and considered by him the true source of the Nile. Usumbura and the whole Tanganyika region was found to be a prey to sleeping sickness, though strenuous efforts are being made to cope

with it. In the last letter, written from Dar-es-Salam, Prof. Meyer gives a general sketch of the physical, ethnographic, and economic relations of the districts passed through. He insists on the need of extending the German railway to Ujiji * and opening communication with the north of Tanganyika by steamer. This would afford the best route to the highlands of Western Ruanda and Urundi, where settlement by Germans is advocated.

New Route across the Kalahari Desert.—The latest report on the affairs of the Bechuanaland Protectorate contains some interesting particulars of proposals for opening up a new route across the Kalahari desert. At present travellers to Lake Ngami leave the railway at Palapye Road and proceed by Serowe across the northern part of the desert to the Botletle river. The road is a long and roundabout one, the distance between Serowe and Tsau, the principal town in Ngamiland, being over 500 miles. The shortest route to Lake Ngami would be from a point somewhere on the Molepolole-Lehututu road, and across the Kalahari in a north-westerly direction, passing close to the Boer settlement at Ghanzi. Such a road would only be practicable if wells producing sufficient water could be sunk at intervals along it. Writing in September last from Mafeking, Mr. Barry May, Acting Resident Commissioner, stated that arrangements had been made for three or four wells to be put down, and as a preliminary a Scotsman named McTavish had made a journey with a Scotch cart and oxen along the proposed route, only in the reverse direction from that indicated. From the time he left Ghanzi to the time he struck the Molepolole-Lehututu road he found no permanent water, but thunderstorms occurred at intervals, and in many places melons were found which supplied his cattle with all their wants. Mr. May writes in terms of warm admiration of the determination and courage shown by Mr. McTavish in undertaking such a hazardous journey, which led for over 250 miles through unknown country. He also points out that north of the route traversed by Mr. McTavish there extends a tract of country 200 miles in length by about the same in breadth which has never, so far as Mr. May is aware, been crossed by Europeans. It was in this region that "Anderson's Vlei" used to be shown on the maps, but Mr. May supports the conclusion already reached by geographers, that this Vlei has no actual existence. The wandering tribes of Bushmen who alone roam over this part of the Kalahari declare that they know nothing of such a lake, either past or present. In their wanderings over the desert they exist without water, relying for drink solely on the juice of wild melons; but if water can be found by sinking wells, Mr. May believes that it will be possible to turn much of this country to good account, for, given water, the Kalahari is well adapted for cattle ranching.

The Region north-east of Lake Chad.—Some additions to our knowledge of this inhospitable portion of the Sahara have resulted from a reconnaissance by Lieut. Roucaud in 1909, which led through Egei to Toro by a route some distance to the north of that followed by Captain Bordeaux in 1907 (*Journal*, vol. **33**, p. 498). The following details are taken from a brief narrative published in the *Renseignements Coloniaux* of the Comité de l'Afrique Française, 1911, No. 10. The route—which left the north-to-south Bilma-Chad route a little south of 16° N., and took a general west-south-west to east-south-east direction—followed at first the line of separation between the arborescent vegetation of the south and the steppe or desert flora of the north; the country

* The railhead was distant only three and a half days' journey from Tabora at the time of his stay at the latter.

consisting of an undulating sandy plain rising often into dunes. The line is marked by a series of wells, near which representatives of the two floral regions mingle. Most of these wells have lately fallen into disrepair, owing to the prevailing insecurity, but the region was not long ago the scene of an active pastoral life. Going east, the traveller in time passes into an almost level plain of sand, destitute of vegetation, and in this direction the bones of fish and rolled pebbles become more and more numerous. The district of Egei, towards which the level sinks gradually, is little differentiated from the surrounding country, except by its calcareous deposits. The most depressed portion, Kukurde, produces babul trees (*Siwak* of the Arabs) and thin pasturage. Water exists at a slight depth below the surface, but it is in places strongly impregnated with saltpetre. The further route leads across the Moji plateau, almost destitute of vegetation, and, crossing a barrier of dunes, drops into the depression of Toro, rendered almost green by its vegetation of dum palms, babuls, etc. It lies 50 metres lower than Egei and 60 lower than Lake Chad. Still, Lieut. Roucaud thinks there can never have been a flow of water between this part of the Sahara and the lake, but the evidence points to the former existence of an inland sea. In drying this gave place to two lakes, one represented by the Chad, the other by Egei and Toro, though in the almost total absence of rain the latter has in course of time disappeared. The south-western limit of this old sea, as indicated by the present distribution of fish-remains, etc., seems to have run from Homoji, south-east of Agaden, to Dire, a little west of Egei; while in the opposite direction it extended to the uplands of Tibesti and Borku.

The Kordofan Railway.—A Reuter telegram from Wad Medani, despatched on December 30 last, announced the completion of the railway from the Nile to El Obeid, the capital of Kordofan, which had been under construction for some time (cf. *Journal*, vol. **35**, p. 333, and the map of Kordofan by Captain Lloyd in the same volume). Though now open for traffic, the formal inauguration by the Sirdar is to take place during the present month.

Bangweulu Swamps: Erratum.—In the map illustrating Mr. Melland's paper in the *Journal* for October last, the depth inserted near the base of the map just west of Chafye island should read "6 to 9 *inches* deep (Sept.)," not "feet."

AMERICA.

Precipitation and Altitude in the Sierra Nevada.—A study of the relation to be traced between amount of precipitation and altitude in the Sierra Nevada of California, by Mr. C. H. Lee, appears in the *Monthly Weather Review* for July, 1911. While it is of course a recognized fact that, broadly speaking, rainfall increases with altitude, the ratio is by no means a simple one, as many other factors come into play. Mr. Lee, who belongs to the engineering staff of the Los Angeles aqueduct, has carefully got together all the available rainfall data, including the observations taken in the Owens valley in connection with the aqueduct works; and besides constructing an isohyetal map of the area, he has worked out tables and diagrams showing the variation of precipitation with altitude along certain definite cross-sections through the range. The result is to show a generally similar relation throughout. There is an increase of precipitation with altitude from the floor of the Great valley up the western slope of the Sierra to about the 5000-feet level, the rate of increase being greatest in the lower foothills and steadily diminishing with increase of

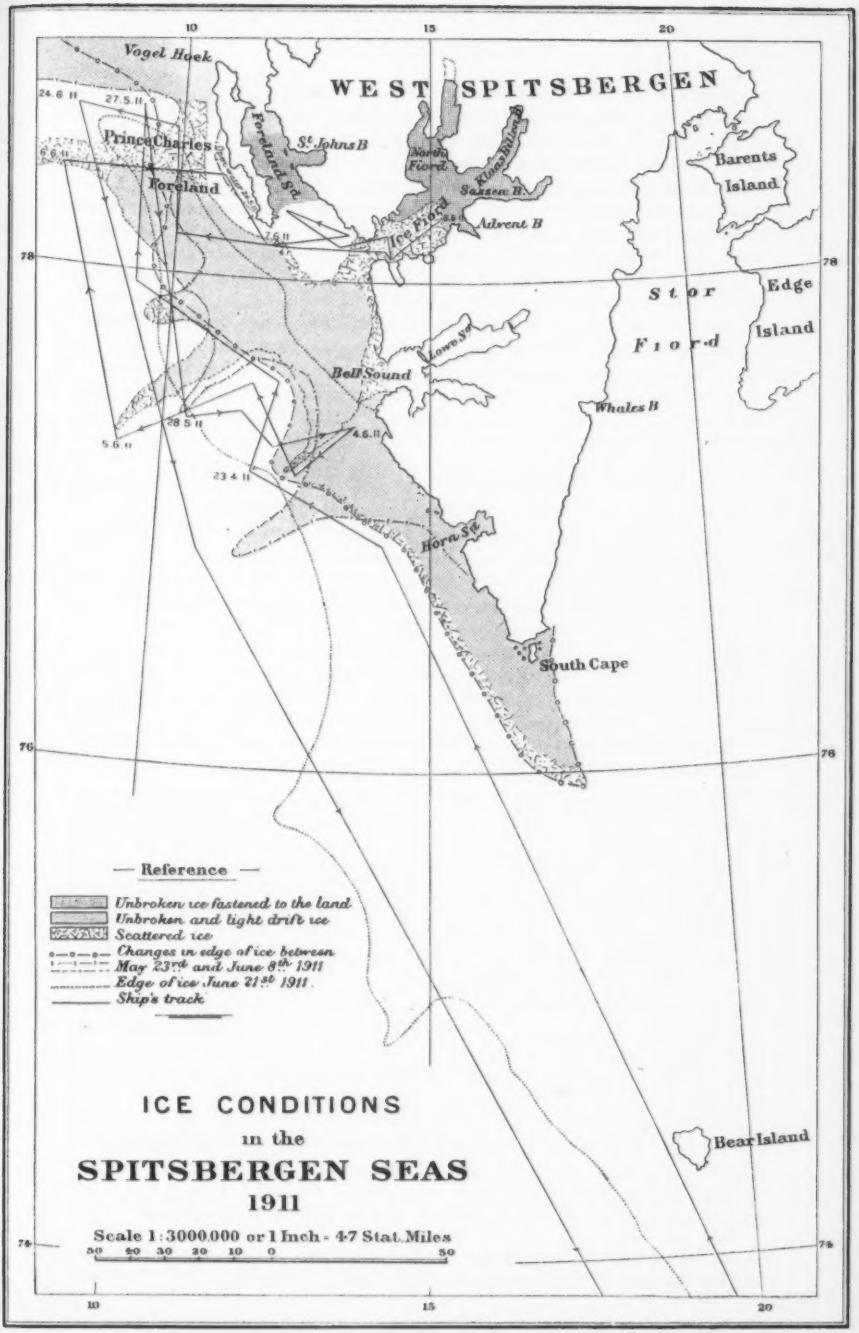
elevation. Above 5000 feet there is a moderate decrease with altitude, at a practically constant rate, until the crest is reached; while east of this precipitation decreases rapidly with decrease in altitude, maintaining a constant rate down to 5000 feet and a decreasing rate below that level. Thus, while the curves of topography and precipitation are generally of the same shape, the maxima of the latter occurs west of the topographic crest. A similar relation has been found to exist on the southern slope of the Himalayas, where the critical elevation has worked out as 4160 feet above sea-level. In both cases the relation conforms to a general law, the condition being that of the broad slope of a long mountain range presented to a prevailing moisture-laden wind. The ascent of the latter up the slopes results in expansion and cooling of the air until condensation occurs. The latent heat thus liberated then tends to raise the temperature above the dew-point. On the other hand, the descent on the leeward slope is accompanied by a rapid compression and rise in the temperature of the air. The general slope of the country has thus more to do with precipitation than has altitude pure and simple.

"**Indian Summer.**"—The use and origin of this familiar term have once more been discussed in the *Monthly Weather Review* (March, 1911), this time by Mr. Josiah Morrow.* The use of the term is apparently not very much more than a century old in America, where it originated and thence spread to England, where De Quincey is cited as using it in 1830. Mr. Morrow describes very accurately the "Indian summer" as "a spell of pleasant weather in the late autumn or early winter, characterized by warmth, calmness, and a hazy atmosphere. Although the true origin of the phrase may, like so many expressions, never be traced, there is good reason to believe that the name originated with white men and not with the Indians of North America. It is suggested that the "Indian summer" was the season when the Indians burned the woods and dry grass, and that the smokiness was the result of such grass-burnings on the extensive prairies of the north-west. The Indian summer, we may observe, is not an uncommon manifestation of weather in the British islands in September or the first week of October, and after inclement summers, especially in Scotland, may form the most genial period of the whole year. The days are warm and sunny, with a cloudless blue sky overhead, but thick horizons, and the nights are usually damp and foggy. The Indian summer is really but an extreme manifestation of that beautiful serene type of weather which is so characteristic of September when the month is mild, which, of course, is not always the case. In June and July, on the contrary, the weather is nearly always violent in some form or another, and if the fierce midsummer sun cannot, owing to the general meteorological conditions, act directly in causing severe heat and drought, it will act indirectly by drawing up those persistent, unpropitious rainstorms which sometimes keep the midsummer period so uncomfortably cool in England; and it is just for the very reason that the sun is fast declining and the "potential" temperature therefore falling, that the clouds so often disperse and the rainstorms cease in a September following an inclement summer, permitting the actual temperature to rise and furnish an "Indian summer."

POLAR REGIONS.

Norwegian Expeditions to Spitsbergen.—The expedition to which

* A previous discussion in the same paper was referred to in the *Journal*, vol. **20**, p. 458.


10
15
20
Vogel Hoek
WEST SPITSBERGEN
24.6.11
27.5.11
Prince Charles
Foreland
6.6.11
Foreland Sd.
St. Johns B.
North Fiord
Klaas Billen B.
Sassen B.
Barents Island
Ice Fiord
Advent B.
78
Stor Fiord
Edge Island
Bell Sound
Lown Sd.
Whales B.
28.5.11
5.6.11
4.6.11
23.4.11
Horn Sd.
South Cape
76
— Reference —
Unbroken ice fastened to the land
Unbroken and light drift ice
Scattered ice
Changes in edge of ice between May 23rd and June 8th 1911
Edge of ice June 21st 1911.
Ship's track
ICE CONDITIONS
in the
SPITSBERGEN SEAS
1911
Scale 1:3000000 or 1 Inch = 47 Stat. Miles
50 40 30 20 10 0 50
Bear Island
74

reference was made in the *Journal*, vol. **38**, p. 538, returned to Tromsö during the autumn, and a summary of the work accomplished has been given by one of the geologists, Dr. A. Hoel, in *La Géographie* (vol. **24**, 1911, No. 4). Green harbour, in Ice fiord, was reached on July 9, but the unusual extent of ice on the coast and in the fiords interfered to some extent with the plans laid down. The first part of the time was devoted to geological and photogrammetric work between Green harbour and Bell sound, but on July 25 the expedition divided, the geologists proceeding to the north coast to investigate the Devonian and volcanic region of Wood bay, while the topographers (Captain Staxrud and Mr. A. Koller) continued their work inland from Green harbour and Bell sound. To the north the state of the ice was extremely unfavourable, being more compact and closely pressed against the coast than had been known within the memory of man. It was quite impossible to reach Wood bay by sea, and after various researches in the peninsula to the west of it (including an examination of the lines of stones previously placed on the Lilliehook glacier), Dr. Hoel returned south, while his colleague, Dr. Holtedahl, undertook an expedition inland from King bay, which took him first to Wood bay and then south to Ekman bay in Ice fiord—one of the most extensive journeys yet made in the interior. We are informed by Captain G. Isachsen that a preliminary report on the geological results of recent researches in Spitsbergen, promoted by him, was laid before the Geological Society of Christiania by Dr. Holtedahl on December 12 last. The lecturer dealt especially with the studies carried out in the sandstone area in the north of Spitsbergen. The explorers have discovered here a rich, hitherto unknown fauna of Devonian age, consisting of molluscs which had lived in brackish water. Enormous specimens were found, together with curious species of fishes belonging to the most ancient fish-fauna. Numerous representatives of other curious fishes were found among the higher layers. The rich material brought back—some tons in weight—which has been made over to the university, will, together with the studies in the field, permit a full palæontological and stratigraphical description of this formation to be given.

Ice Conditions in the Spitsbergen Seas.—Captain Gunnar Isachsen sends us some notes relative to the ice-conditions off Spitsbergen during the past year, together with a map based on the observations of Captain H. Naess, of the steamship *William D. Munroe*, belonging to the Arctic Coal Company. Last winter appears to have been colder than usual on the west coast, temperatures as low as – 50° C. (– 58° Fahr.) having been registered at Advent bay. The bays froze somewhat early, in October, and did not become clear last year until later than in 1910. The *William D. Munroe* was eighteen days under way on the first trip last year, viz. from May 20 to June 8, and the border of the fast ice on the west side of Advent point was then 2 miles from the bay. When returning to Tromsö a week later, Captain Naess found little change. On the north, and in the Stor fjord on the east, the ice-conditions had been much the same as in the previous year, though the outflow of ice from the Stor fiord westward had been considerable. The Arctic Coal Company above mentioned had had about eighty men at work, and during the winter some 20,000 tons of coal were taken out. This has been exported to Norway, as far south as Haugesund. Both the winter hunting and the summer sealing operations had been very unsuccessful, and the wintering parties, some of which suffered severely from famine, will probably be given up.

The Antarctic Expeditions.—Captain Scott's ship the *Terra Nova* finally left Christchurch, New Zealand, on December 14, *en route* for the explorer's

base-station in McMurdo sound. Dr. Mawson's expedition sailed from Hobart in the *Aurora* on December 2, and reached Macquarie island all well, after a rough passage lasting over a fortnight. The announcement of the arrival at this island is said to have been made by wireless telegraphy, an installation of which, as already mentioned, forms part of the equipment. It is not clear whether the whole distance between Macquarie island and Hobart was covered in this way, but in any case Dr. Mawson has shown that valuable assistance may be expected from such an installation in an undertaking like his own. Before leaving Australia, an enthusiastic send-off had been given to the party by a gathering at the Adelaide Town Hall on November 18. It was presided over by the Governor, Sir Day Bosanquet, who, with other speakers, testified to the confidence felt in Dr. Mawson as leader of the expedition, and offered their good wishes for its success. It will be remembered that the Government of South Australia was the first to come forward with substantial help towards the funds of the expedition.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Seiche Phenomena in Lakes and Seas.—Under the title "Some Analogies between Lakes and Oceans," an article by Mr. E. M. Wedderburn, of Edinburgh, in the *Internationale Revue der gesamten Hydrologie und Hydrographie* (Band 4, Heft 1 und 2), discusses a subject of peculiar and fascinating interest alike to the mathematician, the physicist, and the geographer. Mr. Wedderburn endeavours to speculate how far the knowledge which we have recently gained of seiche disturbances in lakes, both of the ordinary seiche and the essentially similar, though differently conditioned, temperature or **T**-seiche, may be applied to the ocean where researches have hitherto been so scarce, and where they are infinitely more difficult to undertake. The ordinary seiche has, in fact, been observed in bays and enclosed parts of the sea in various parts of the world, as along the Japanese coast, where they show a node at the mouth of the bay and a loop at the head, and cause embroideries on the tide-gauge records. The period of oscillation of these seiches or standing waves in a bay admits of calculation from the shape of the bay. Oscillations in the sea surface and anomalies or irregularities in marine circulation have, moreover, been discovered such as might well be explicable on the assumption of a **T**-seiche of large period and amplitude. But the most important question in connection with seiche phenomena is that raised by Mr. R. A. Harris's explanation of the tides themselves as seiche phenomena. Although further observations are desirable, tide records, so far as available, seem to support Harris's theory of a great semi-diurnal seiche in the Atlantic between the American coast and the Cape Verde islands, another in the land-locked portion of the Indian ocean, yet another south of Australia, and so forth. In this way Harris has divided the whole of the oceans into compartments which might be expected to have semi-diurnal oscillation periods, and he has drawn nodal lines where no rise or fall of the sea-surface takes place (but where presumably a horizontal current must occur instead), and also indicated points where no rise and fall would occur on account of the interference of two systems of oscillations. In connection with seiche currents Mr. Wedderburn refers to the rapid increase in the velocity of a current which takes place over a rapid shallowing of the sea-floor. At many places round the English coast—as off Peveril point, Swanage, for example—where a naturally strong tidal current is increased by the well-known "race" normal off

a point, and greatly increased still further by a rapid shallowing of the water over a ridge in line with the point, the change of velocity is in certain states of the tide so sudden as to give rise to a veritable wall of water. Such a discontinuity, however, will always be evidenced by a black line—Nature's danger signal—of which a boatman may well take heed, for if he once crosses that line he may find himself in a current in which he might smash his oars in the attempt to row back. With respect to a **T**-seiche conditioned by the presence of a temperature discontinuity some distance below the surface of a lake, Mr. Wedderburn remarks that the amplitude may be nearly as great as the depth of the water above the discontinuity, vortices are produced along the line of separation of the upper and lower layers, whilst at the node currents will be established in opposite directions above and below the discontinuity, the velocity being much less in the bottom layer on account of its much greater depth.

GENERAL.

Gilchrist Geographical Studentship.—We are pleased to announce that a geographical studentship of the annual value of £100 has been established by the Gilchrist Educational Trust, in response to a suggestion of the Geographical Association, supported by this Society. The proposal was considered last year by a joint committee of the two bodies, with the late Dr. R. D. Roberts, who took a warm interest in the scheme, as representing the trustees. The regulations for the administration of the studentship, proposed by the committee, have since, with slight modification, been approved by the trustees. It is laid down that the studentship shall be awarded with a view to advanced work on the part of the recipient, who must be a teacher, or person intending to be a teacher, possessed of suitable qualifications either as having passed through a special course of geography such as is provided at Oxford, Cambridge, or the London School of Economics, or in the form of previous experience as a teacher. The student must pursue a definite course of study to be approved by the trustees (such as the study of a definite region with the view to the publication of a monograph), preferably under the guidance of a University teacher of geography. At least nine months must be devoted to the work. An annual award of the studentship, to be made by a joint committee of the Geographical Association and this Society, appears to be contemplated, though this would no doubt depend on the qualifications of the applicants, which are to be laid before the committee for consideration.

The J. J. Rein Fund for the Encouragement of Geographical Research.—In commemoration of the seventieth birthday of Prof. J. J. Rein, January 27, 1905, the friends of this well-known German geographer instituted a fund (to which this Society contributed among others), the yearly income of which should be devoted, in some way or another, to the furtherance of geographical research. The contributions made then and since to the fund reached, in November last, a total of nearly 9000 marks, and in the same month the rules for the administration of the fund were drawn up. It is proposed, unless reason to the contrary should arise, to wait until the fund has accumulated to 10,000 marks before making a grant of the interest, which alone is to be expended, the capital remaining intact. Grants will be made with a view to giving young geographers the opportunity of travel and research, and the recipients must be Germans or Japanese, while preference will be given to students in the University of Bonn and in the Commercial College at Cologne. The fund will be administered by a small committee, on which Prof. Rein will serve during his lifetime.

The Association of American Geographers held its eighth annual meeting in Washington, December 28–30, 1911, under the presidency of Prof. Tarr, who chose as the subject of his address, "The Glaciers and Glaciation of Alaska." According to the programme issued beforehand, the subjects of the papers read covered a wide field, dealing with the economic, cartographical, morphological, and climatic aspects of geography, some even verging on pure meteorology. Those with a special application to the conditions of human life include the following: "Geography and Human Construction," by Prof. R. E. Dodge; "Industries of Wisconsin and their Geographic Basis," by R. H. Whitebeck; "The Authropography (*sic*) of North America," by Prof. Mark Jefferson. The relation of soils, etc., to population was discussed in a paper by H. H. Bennett, and bio-geographical subjects were dealt with in several papers. Purely physical geography was represented by papers on "The relation between Ground Water and Streams" by Prof. McGee; on "Beach Ridges of Northern and Southern Sweden," by D. W. Johnson; and others. Under the climatic section we find discussions of such subjects as the humidity factor in ventilation of dwellings; the key to climatic changes supplied by the Big Trees of California (*cf. Journal*, vol. **35**, p. 335); and the effects of barometric factors on human activities. The list gives an indication of the activity with which the modern science of geography is being studied in the United States.

Captain Cook's Ship the "Endeavour."—An interesting find has been made in New South Wales, according to the *Sydney Morning Herald*, in the form of the shipwright's plan of the *Endeavour*, Captain Cook's ship on his first voyage of circumnavigation, which has been accidentally discovered among a bundle of papers belonging to an old blacksmith named Cummings. This man is said to have obtained the plan, which seems to be the one by which the alterations were carried out for the purposes of the voyage, from a naval carpenter named Korff, who once had a shipyard on the Hunter river, and was a descendant of one Jordan, of the crew of the *Endeavour*. Cummings was just about to burn the papers when they were rescued from this fate by a Mr. Maitland, by whom the plan was passed on to the Australasian Pioneers' Club, which is making a collection of documents bearing on early Australian history. It is dated April 25, 1768, and is entitled "The Draught of His Majesty's Bark *Endeavour*, Her body taken off in the Single Dock," this being followed by a statement of her dimensions, which give an extreme length and breadth of 97 feet 8 inches and 29 feet 2 inches respectively, and a burden of 366$\frac{9}{94}$ tons. The outline drawing of the vessel is said to agree well with other extant representations.

OBITUARY.

Sir Joseph Dalton Hooker, O.M., G.C.S.I., F.R.S.

THROUGH the death of Sir Joseph Hooker a great scientific geographer is lost, and a Fellow of forty-five years' standing in the Society. He was born at Halesworth, Suffolk, on June 30, 1817, the son of a distinguished father, whose fame as a botanist he was to inherit and eclipse. During his childhood and youth his father was professor of botany in the University of Glasgow, and at the high school there, and afterwards at the university, Joseph Hooker was educated. He took the degree of M.D. in 1839.

In youth he had an affection for works of travel and description of distant lands, and his attention was thus early directed to two regions in which he accomplished most important work afterwards—the Antarctic and the Himalayan. An early opportunity came to him of visiting the region first named. When, in 1868, he addressed the British Association at Norwich as its president, he began by referring to his first attendance at one of the annual meetings, in 1838, at Newcastle. "On that occasion," he said, "the Council of the Association resolved to recommend to Her Majesty's Government the despatch of an expedition to the Antarctic region, under the command of Captain James Ross; and it was from Newcastle that I wrote to my friends announcing my resolve to accompany it, in whatever capacity I could obtain a situation amongst its officers. It was then," he continued, "that my scientific career was first shaped." He entered the Royal Navy, and joined the *Erebus* as assistant surgeon, but he acted as botanist on the expedition, during which he visited Australia and New Zealand, Kerguelen island, the Falklands and Tierra del Fuego.

It is impossible here to follow Hooker's career in detail, nor would it be appropriate to catalogue even the more important of his published works. It should be mentioned, however, that in 1845–47 he acted as botanist to the Geological Survey, and was therefore the better prepared for the work which he undertook in the latter year, and which furnished his most important contribution to geography. In 1847 he left England for India, travelled at first in Bengal and Bahar, and thence, by way of Darjiling, entered the Sikkim Himalaya, where he was occupied for nearly two years in both topographical and botanical exploration. In 1850, in company with Thomas Thomson, he studied the botany of Eastern Bengal and the Khasia hills. An appreciation of his Indian work is furnished by Lieut.-Colonel H. H. Godwin-Austen:—

"Hooker entered on his work of exploration in the Eastern Himalaya equipped with just that amount of knowledge which makes the perfect traveller. He was familiar with the plant and animal life of the Palæarctic Region as well as the Antarctic, the use of surveying instruments, and the conduct of a survey on an extended scale, without which knowledge so much time spent on travel in many parts of the world has been thrown away. Hooker's survey of Sikkim is most instructive to the geographer and traveller. It shows what can be done single-handed. In India it has become the fashion to procure the services of native surveyors to do work which Joseph Hooker did himself, while at the same time he was collecting and describing the flora and fauna, and studying the physical features of the country with marvellous accuracy, so that the record is instructive now, after the lapse of sixty years. I suppose no book of travel produced a greater effect and gave so much pleasure to those who read it as did the publication of the *Himalayan Journals* in 1854. It is, indeed, for a book of the kind, a pattern to be taken by any writer. It has interested hundreds, made many a naturalist, and exemplifies on every page what a precious gift is that of observation. Such a book was particularly wanted in India when it came out. Large and unknown areas of country had lately come under our rule, and officers in the service were in the course of their duties seeing very much that was new and interesting. Here they had a book dealing with trees and plants, the fauna, the geology, physical geography, and ethnology, together with descriptions of the scenery so perfect that not a single character of importance is left out. I know it produced a great effect upon me at the time.

"Hooker's personal knowledge, as well as that of what had been done by

others, enabled him to form a very comprehensive idea at that time of the Himalayan range and its relation to the main mass to the north. His observations in Sikkim are of the deepest interest in connection with the more recent geological history of the Himalaya both east and west. He was the first to notice the former extension of glacial action far below the present limits, and here his antarctic experiences and knowledge of ice action were of enormous advantage. His description of the Yangma valley and the ancient moraines at 10,000 feet is noteable and instructive reading even now. It considerably modified pre-existing views, and showed how great must have been the influence on the climate of India and on the distribution of its fauna and flora. His record of fossiliferous rocks, encrinites and possibly nummulites near the Donkia pass (16,900 feet) was another valuable addition to the physical knowledge of this country, pointing to the fact that in the Cretaceous period an ocean occupied this portion of the Earth's crust.

"My survey duties took me to Darjiling, Sikkim, and Bhutan in 1863–64, and later again to the Khasia and Jaintia hills, so that Hooker's Himalayan work was daily before me, ever conveying valuable knowledge. On my first grand view from the trigonometrical station of Senchal, on a brilliant clear morning, of the Eastern Himalaya, embracing an arc from Mount Everest on the west to Chumalarhi on the east, when I was commencing a plane-table survey of the country between Darjiling and Punakha in Bhutan, I first unrolled Hooker's map, published in the Surveyor-General's Office, and soon discovered how excellently it had been constructed—with the exception of Henry Strachey in Ladak, I do not know of any surveying by a traveller in the Himalayas which can be compared with it for accuracy of detail."[1]

It was a curious accident of Hooker's career that the opportunities to collect materials for some of his greatest works from these two different quarters of the globe, should have thus occurred almost consecutively in his early life. That he should have made such use of these materials, in the midst of his subsequent official and other labours, is a tribute to his wonderful industry. In 1855 he became assistant direct r under his father at Kew. The year 1860 saw the completion of his Antarctic results, which appear in three sections, dealing with the flora respectively of the Antarctic itself, of New Zealand, and of Tasmania. In the same year he went to Syria and Palestine on a scientific journey, in course of which he studied the cedars of Lebanon. From 1865 to 1885 he was director of the gardens at Kew, during which period visits to North-West Africa (1871) and the western states of the Union (1877) were added to his travels. As the result of the African journey, Hooker and Ball published in 1878 the 'Journal of a Tour in Morocco and the Great Atlas.' This deals largely with floral distribution, in which connection the Canary islands also are dealt with. A geographical study of southern Morocco, with an original map, is included. The various works which were the outcome of the Indian journey, including many papers, and the 'Flora Indica,' written in conjunction with Thomson, reached a culmination only in 1897 with the issue of the seventh and last volume of the 'Flora of British India.' Hooker dealt with the Arctic plants collected by Franklin search parties and the McLintock expedition in his 'Outlines of the Distribution of Arctic Plants' (1861). A much later work was the editing of the 'Journal of Sir Joseph Banks' during Cook's first voyage. The wide geographical range of Hooker's botanical interests may be summarily indicated by the mention of lands other than these referred to in connection with his travels, to a study of whose flora he contributed. Such were Fernando Po, Kamerun, the Galapagos islands and Ceylon; a study of the subalpine vegetation

of Kilimanjaro may also be noticed. His especial interest in insular floras is illustrated by the Evening Discourse delivered on that subject before the British Association in 1866 at Nottingham.

Geographers, owing so much to Charles Darwin, owe only less to Hooker as his staunch supporter. This attitude is best illustrated in his presidential address to the British Association, referred to above. But he revealed it again, on an occasion of more intimate interest to us, when he presided over Section E (Geography) of the Association in 1881. This was the fiftieth anniversary meeting; in the sectional chairs appear a notable list of past presidents of the Association, and that of geography, as Hooker modestly remarked, "from the fact of there being no professed geographer amongst the surviving past presidents," was "confided to an amateur." He chose distribution as his subject, showed how "in the science of distribution, botany took the lead," and stated that "as Humboldt was its founder, and Forbes its reformer, so we must regard Darwin as its latest and greatest law-giver."

Hooker became a Fellow of our Society in 1866; he served on the Council, and in 1883 he received the Founder's medal "for his eminent services to scientific geography." At meetings of the Society he spoke on various topics; his views on geographical education are strongly expressed in the *Proceedings*, vol. 8, p. 197 *seqq*. Geography, he said, should permeate the whole of education from the schoolroom to the end of the University career. He died on December 10, 1911, at his home near Sunningdale.

George Murray, F.R.S.

We regret to record the death, which occurred at Stonehaven on December 16, 1911, of Mr. George R. M. Murray, formerly keeper of the Botanical Department at the Natural History Museum at South Kensington, with which he had been connected since 1876. Mr. Murray was specially attracted to the study of the sea, particularly its botany, and he took part in several scientific voyages for the collection of marine organisms. In 1898 he himself organized a cruise in the Atlantic west of Ireland—an area lying off the usual tracks of vessels, and of which the fauna and flora were imperfectly known—bringing back valuable results, of which a preliminary outline was given in the *Journal* for February, 1899. But he was best known to geographers in connection with Captain Scott's first Antarctic Expedition, for which he undertook the editing of the 'Antarctic Manual,' besides generally superintending the preparations for biological research during the expedition, to which he acted as scientific director. His duties at the Museum prevented him from taking part in the whole expedition, but he accompanied it on the outward voyage as far as the Cape, and was thus able to assist the observers at the outset of their duties, and to see the work satisfactorily inaugurated. The breakdown of his health compelled his retirement from the Museum, and the last years of his life were quietly spent at Stonehaven, his birthplace. He became an F.R.S. in 1897.

William Blakeney.

Paymaster-in-Chief William Blakeney, R.N., died at Bath on January 2, aged seventy-seven years. Entering the civil branch of the naval service at an early age, he sailed for Australia in 1851, and soon received an appointment in the

survey branch, being engaged until 1856 in the survey of the coasts of New Zealand in the *Pandora*. He then joined the *Actæon* frigate in the double capacity of Assistant Paymaster and Assistant Surveyor, and took part in various operations in the Eastern seas, being present at the capture of Canton in 1857 and at the bombardment of Nanking in 1858, besides doing much important survey work on the coast of Formosa, on the lower Yang-tse, and elsewhere. His work of this kind in the sea of Japan and neighbouring waters was notable for the first exploration of Port Arthur, and he subsequently was engaged in survey work on the coast of British Columbia. After 1866 he served at home in the Hydrographical Department, from which he retired through ill-health in 1882. During this period he was brought into close touch both with the *Challenger* Expedition and with the Arctic Expedition under Nares in 1875–76. Only in 1902 he described his varied experiences in the Eastern seas in his book 'On the Coasts of Cathay and Cipango Forty Years Ago,' which records many stirring events, vividly and racily narrated (see *Journal*, vol. 21, p. 442) In his latter years he had done a good deal of lecturing, in part in support of missionary enterprise, of which he was a zealous supporter.

Arthur de Claparède.

The Society has lost one of its Honorary Corresponding Members in the person of M. Arthur de Claparède, who died at his residence near Geneva on December 13 last, at the relatively early age of fifty-nine years. After taking the degree of Doctor in Law at the early age of twenty-three, M. de Claparède soon became Secretary of the Swiss Legation at Vienna, and in 1877 went to Berne as Secretary of the Political Federal Department—a post which ill-health compelled him to relinquish at the end of six years. He was one of the most zealous supporters of geography in Switzerland, and had long been closely identified with the Geographical Society of Geneva, which he joined in 1887, and of which he was many times President. On the occasion of the Geneva meeting of the International Geographical Congress he was chosen as its President, an office which he filled with great success. Besides three books of travel, contributions from his facile pen, on subjects geographical, political, economic, etc., are scattered over a large number of periodicals.

Captain L. W. D. Everett.

Captain Everett, who, as announced last year in the *Journal*, went out under Major Gillam as surveyor on the British-Belgian Boundary Commission in South Central Africa, has, we regret to record, met his death in Rhodesia *en route* for the scene of his labours. Being attacked, while hunting, by a wounded lion, he was so badly mauled that he died the same day. Captain Everett, who was born in 1875, and had seen service in Somaliland and elsewhere, was a capable officer, and his premature death is much to be deplored.

Henry Stone.

An Arctic veteran—one of the survivors of the crew of the *Investigator* on her voyage in search of Franklin in 1850 and following years—has passed away in the person of Mr. Henry Stone, who died at Bedonwell, Belvedere (near Erith, Kent), on December 6, 1911. Before sailing with McClure, Mr. Stone had been a blacksmith in Woolwich dockyard; but he volunteered for service with the search

expedition, and went through all the thrilling experiences of that memorable voyage, until, after the abandonment of the ship and the rescue of the crew by a party from the *Resolute*, the survivors returned to this country after an absence of over four years. After his return, Mr. Stone re-entered Woolwich dockyard, and, on its being closed in 1869, opened a blacksmith's business at Bedonwell, which he carried on for thirty years. Last summer he was seized with paralysis, to which, after a partial recovery, he eventually succumbed. On his illness, a subscription in his behalf had been raised by old Arctic officers and others interested in his career.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1911–1912.

RESEARCH DEPARTMENT.

December 14, 1911.

"Thermal Regions of the Globe." By Dr. A. J. Herbertson.

Fourth Meeting, December 18, 1911.—The Right Hon. Earl CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc., President, in the Chair.

ELECTIONS.—*Arthur Edward Beck; G. C. B. Binstead (2nd Essex Regt.); J. Cooper Clark; George Seymour Fort; Ernest W. Hardy; Captain E. O. Henrici, R.E.; Stuart Hogg; Charles Emerson Hovey; J. W. Johnson; Merton King; Christopher William Lowther; J. F. Mason, M.P.; Sidney William Masterman; J. H. Miller; Dennis Joseph Mullen; Miles Lucas Phillips; W. J. Sheehan; Cyril Strickland, M.A.; Arnold Jacob Cohen Stuart; J. Moffat Thomson; Balcombe Langridge Seaton Winton.*

The paper read was:—

"North American Deserts." By Dr. T. MacDougall.

CHRISTMAS LECTURES TO YOUNG PEOPLE.

January 5, 1912.—"Amongst the Alps." By Julian Grande.

January 8.—"Our World-wide Empire." By W. Herbert Garrison.

January 11.—"A Lady's Journey in the Central Sudan." By Miss Olive MacLeod.

Fifth Meeting, January 15, 1912. The Right Hon. Earl CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc., President, in the Chair.

ELECTIONS.—*Ernest Edward Gomersall; Edmund Woodhouse Hedgeland; Arthur Holmes; Henry Victor Janau; Colonel Samuel Foster Longheed, C.M.G., R.A.M.C.; Claude Herbert Marshall, M.R.C.S.; James Cosmo Dewhurst Melvill; L. C. F. Oldfield; Rev. Austin Silas Rogers; Slingsby Shafto; Lieut. William Hampden Silver (King's African Rifles); J. W. Stuart Smallwood; Captain H. H. J. Stockley.*

The paper read was:—

"Chinese Frontiers of India." By Archibald Rose, C.I.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Alpine lake. *Petermanns M.* 57 (1911) II.: 205. **Endrös.**

Zur Tiefe des Mondsees und der Periodendauer seiner einknotigen Seiche. Von Prof. Dr. A. Endrös. *Diagram.*

Austria—Vienna. *Petermanns M.* 57 (1911) II.: 203–204. **Müllner.**

Der Schutz Wiens gegen Donauüberflutung. Von Prof. Dr. J. Müllner.

Bulgaria—Population. *Petermanns M.* 57 (1911) II.: 117–122, 179–185. **Ischirkoff.**

Die Bevölkerung in Bulgarien und ihre Siedlungsverhältnisse. Von Prof. Dr. A. Ischirkoff. Autorisierte Uebersetzung von A. Kassner. *Maps.*

Carpathians—Morphology. **Sawicki.**

Drei subkarpatische Pforten—eine vergleichend-geographische Skizze. Von Dr. Ludomir Sawicki. Lemberg, 1911. Size 9 × 6, pp. 559–584. [In Polish; German *résumé*.]

Central Europe—Railway. *Petermanns M.* 57 (1911) II.: 198–199. **Heiderich.**

Die Schweizer Adriabahn. Von Prof. Dr. Franz Heiderich.

Crete—Archæology. **Seager.**

Univ. Pennsylvania Anthropol. Publ. 3 (1910): No. 1, pp. 38.

Excavations on the island of Pseira, Crete. By Richard B. Seager. *Plan and Illustrations.*

Denmark—Geodesy. **Danske Gradmaaling.**

Den Danske Gradmaaling, Ny Raekke, Hefte Nr. 7. 18 Breddebestemmelser udførte 1897–1899 efter v. Sternecks Fremgangsmaade. Udgivet af Generalmajor V. H. O. Madsen; bearbejdet af Oberst M. J. Sand. Copenhagen, 1911. Size 11 × 9, pp. viii. and 88.

Europe—Coasts. *Z. Ges. E. Berlin* (1911): 543–560. **Braun.**

Einige Ergebnisse entwickelungsgeschichtlicher Studien an europäischen Flachlandsküsten und ihren Dünen. Von Dr. Gustav Braun. *Sketch-map, Illustration, and Section.*

Europe—Germany. **Kossinna.**
Die Herkunft der Germanen. Zur Methode der Siedlungsarchäologie. Von Gustaf Kossinna. (Sonderabdruck aus 'Mannus-Bibliothek herausgegeben von Prof. Dr. Gustaf Kossinna,' No. 6.) Würzburg, 1911. Size 10½ × 7, pp. 30. *Map.*

France—Alps. **Coolidge.**
Les Cols de la Chambre et de la Montée du Fond. Par W.-A.-B. Coolidge. (Extrait de la *Revue Alpine* de Juin, 1911.) Lyon, 1911. Size 9½ × 6½, pp. 8.

France—Aviation Map. *Ann. de G.* **20** (1911): 311–315. **Pollacchi.**
La Carte Aéronautique du Service Géographique de l'Armée. Historique, projet, et exécution. Par le Commandant P. Pollacchi. *Map.*

France—Drôme and Vaucluse. **Ardouin-Dumazet.**
Ardouin-Dumazet. Voyage en France. 57e Série. Bas Dauphiné—Comtat-Venaissin. Paris: Berger-Levrault, 1911. Size 7½ × 4½, pp. viii. and 462. *Maps and Plans. Price* 3 *fr.* 50.

France—Gascony. **Cobb.**
Landes and Dunes of Gascony. By Collier Cobb. (Reprinted from the *Journal of the Elisha Mitchell Society*, November, 1910.) [Chapel Hill, N. C.], 1910. Size 9½ × 6, pp. 82-92. *Sketch-map and Illustrations.*

France—Gascony. *Ann. G.* **20** (1911): 143–154. **Laurent.**
L'Armagnac et les pays du Gers. Par Gustave Laurent.

France—Jura. *Spelunca* **8** (1910): No. 62: pp. 40. **Fournier.**
Recherches spéléologiques et hydrologiques dans le Jura Franc-Comtois. Par M. E. Fournier. *Sections.*

France—Limousin. *Ann. de G.* **20** (1911): 316–337. **Demangeon.**
Le Montagne dans le Limousin. Etude le géographie humaine. Par A. Demangeon. *Map and Illustrations.*
See note in the November number, p. 528.

France—Morphology. *Ann. G.* **20** (1911): 30–43, 122–142. **Briquet.**
Sur la morphologie de la partie médian et orientale du Massif Central. Par A. Briquet. *Sketch-maps and Sections.*

France—Rhone valley. *Z. Gletscherkunde* **6** (1911): 31–67. **Kilian.**
Contributions à l'histoire de la vallée du Rhône à l'époque pléistocène. Le défilé de Fort-de-l'Ecluse (Ain). Par W. Kilian. *Illustrations and Sections.*

France—Roubaix. **Société de Géographie de Roubaix.**
Roubaix ancien et moderne . . . (30e Congrès National de Géographie. Roubaix, 1911). [Roubaix: H. Pique, 1911.] Size 11 × 7½, pp. 166. *Plans and Illustrations. Presented by C. H. Bellamy, Esq.*

France—Savoy—Erosion. *C.R.A. Sc. Paris* **153** (1911): 404–407. **Martonne.**
Résultats de l'analyse morphologique des niveaux d'érosion des vallées de l'Arc et de l'Isère. Par Em. de Martonne. *Sections.*

France—Savoy—Snow. *La G., B.S.G. Paris* **24** (1911): 81–102. **Mougin.**
La neige en Savoie. Par Paul Mougin. *Illustration and Diagrams.*

France—Savoy—Valleys. *C.R.A. Sc. Paris* **153** (1911): 509–512. **Martonne.**
Sur la chronologie des thalwegs pliocènes et quaternaires de l'Arc et de l'Isère. Par Em. de Martonne. *Section.*

France—Seine. *Ann. G.* **20** (1911): 112–121. **Gallois.**
Sur la crue de la Seine de janvier 1910. Par L. Gallois.

France—Shell-fish. *B.I. Oceanog. Monaco*, No. 213 (1911): pp. 14. **Joubin.**
Etudes sur les gisements de coquilles comestibles des Côtes de France. La presqu'île du Cotentin. Par L. Joubin. *Maps.*

France—Shell-fish. *B.I. Océanog. Monaco*, No. 217 (1911): pp. 16. **Guérin-Ganivet.**
Notes préliminaires sur les Gisements de Mollusques comestibles des Côtes de France. Les anses de la côte occidentale du Finistère et l'archipel de Sein. Par J. Guérin-Ganivet. *Map.*

France—South-East Coast. *La G., B.S.G. Paris* **24** (1911): 201–224. **Blanchard.**
Les côtes de Provence: notes de morphologie côtière. Par Raoul Blanchard. *Illustrations.*

France—Vaucluse. **Okey.**
The story of Avignon. By Thomas Okey. ("The Mediæval Towns" Series.) London: J. M. Dent & Co., 1911. Size 7 × 4½, pp. xiv. and 408. *Plans and Illustrations. Price 4s. 6d. net. Presented by the Publishers.*

France, Central—Geology. **Lemoine.**
Géologie du bassin de Paris. Par Paul Lemoine. Paris: A. Hermann et fils, 1911. Size 10½ × 6½, pp. ii. and 408. *Maps and Sections. Price 15 fr. Presented by the Publishers.*

Germany—Bavaria. *M.G. Ges. München* **6** (1911): 209–221. **Jäger.**
Traunstein und das Gebiet der bayerischen Traun. Eine erdgeschichtliche Studie. Von Julius Jäger. *Sketch-map.*

Germany—Bavaria. *Forschungen deuts. Landes.- u. Volksk.* **19** (1911): 353–436. **Mayr.**
Die Siedlungen des bayerischen Anteils am Böhmerwald. Von Dr. Max Mayr. *Maps.*

Germany—Kyffhäuser. *M.V. Geographen Univ. Leipzig* **1** (1911): 67–78. **Behrmann.**
Zur Morphologie des Kyffhäusers. Von Dr. Walter Behrmann.
This small range lies to the south of the Harz.

Germany—Leipzig. *M.V. Geographen Univ. Leipzig* **1** (1911): 14–35. **Rudolphi.**
Das Stadtbild Leipzigs geographisch betrachtet. Von Dr. Hans Rudolphi.

Germany—Meteorology. *Abh. K. Preuss. Met. I.* **4** (1911): pp. 54. **Knoch.**
Der Einfluss geringer Geländeverschiedenheiten auf die meteorologischen Elemente im nord-deutschen Flachlande. Von K. Knoch. *Diagrams.*

Germany—Odenwald. **Spitz and Salomon.**
Geol. Charakterbilder (Stille) **2** (1911): Heft 8. 5 *Plates.*
Der Odenwald bei Heidelberg und sein Abbruch zur Rheinebene. Von W. Spitz und W. Salomon. *Sketch-maps and Sections.*

Germany—Pfälzerwald. **Häberle.**
Ueber Kleinformen der Verwitterung im Hauptbuntsandstein des Pfälzerwaldes. Von Dr. Daniel Häberle. Heidelberg: C. Winter, 1911. Size 9½ × 6½, pp. 44. *Illustrations.*

Germany—Pfälzerwald. *G. Z.* **17** (1911): 297–310. **Häberle.**
Der Pfälzerwald. Von Daniel Häberle. *Map and Illustrations.*

Greece—Climate. **Stange.**
Versuch einer Darstellung der griechischen Windverhältnisse und ihrer Wirkungsweise (nach alten und neuen Quellen). Von Alfred Stange. Meissen, [1910]. Size 8½ × 5½, pp. iv. and 204. *Diagrams.*

Holland—Hydrology. *Ts. K. Ned. Aardr. Genoots.* **28** (1911): 729–757. **Pareau.**
Wat de Haagsche waterleiding ons leert aangaande den hydrologischen toestand der duinen. Door Dr. A. H. Pareau. *Sketch-map and Diagrams.*

Iceland. *Petermanns M.* **57** (1911) II.: 140–143. **Erkes.**
Das isländische Hochland zwischen Hofsjökull und Vatnajökull. Von Heinrich Erkes. *Illustrations.*

Iceland—Morphology. *B. American G.S.* **43** (1911): 489–500. **Russell.**
Physiographical features of Iceland. By W. S. C. Russell. *Sketch-map and Illustrations.*

Italy—Apennines. *Riv. G. Italiana* **18** (1911): 285–288. **Giovannozzi.**
Primi risultati di una ricerca sulla distribuzione delle masse nell' Appennino centrale. Del dott. Ugo Giovannozzi.

Italy—Calabria—Afforestation. *B.S.G. Italiana* IV. **12** (1911): 1114–1138. **Azzi.**
Il problema del rimboschimento studiato in rapporto alle leggi che regolano la evoluzione dei rilievi. Note de geografia fisica del Dr. Girolamo Azzi. I. Aspromonte. *Sketch-map and Sections.*

Italy—Cartography. *R.S.G. Italiana* **12** (1911): 1190–1203. **Giannitrapani.**
La nuova Carta d'Italia al 100,000 del nostro Istituto Geografico Militare. Del Cap. Luigi Giannitrapani. *Maps.*

Northern Europe—Relief. **Sawicki.**

Ludomir Sawicki. Niemen jako klucz do zrozumienia genezy nizu pólnocnego i jego sieci hydrograficznej. [The significance of the Niemen in the morphogeny of the North European plain and its hydrography.] Warsaw, 1909. Size 9½ × 6, pp. 335–342.

North-Western Europe—Historical. **Mulder.**

Ts. K. Ned. Aardr. Genoots. **28** (1911): 801–820.

"Veenbruggen" en de nieuw ontdekte Buinerbrug. Door G. J. A. Mulder. *Sketch-maps and Illustrations.*

On remains of ancient causeways across marshy tracts.

Norway—Glaciers. **Rekstad.**

Bergens Museums Aarbok, 1910, No. 4, pp. 8; 1911, No. 2, pp. 8.

Forandringer ved norske bræer i aaret 1908–09. Av J. Rekstad. *Sketch-map and Illustration.* Ditto 1909–10. By the same. *Diagrams.*

Russia—Don Basin—Geology. **Stepanof.**

Comité Geologique. Carte géologique detaillée du bassin houiller du Donetz. Description des feuilles vii. 25 (pp. iv. and 116) et vii. 26 (pp. iv. et 144). Par P. Stepanov. St. Peterburg, 1910–11. Size 10 × 6½. *Sketch-map and Sections.*

Russia—Meteorology. *B.A. Imp. Sc., St. Petersburg*, VI. **4** (1910): 821–828. **Brishke.**

On the influence of anticyclonic weather on morning temperatures in South European Russia, in relation to topographical conditions. By O. F. Brishke. [In Russian.]

Russia—St. Petersburg—Magnetism. **Rikachef and others.**

B.A. Imp. Sc., St. Petersburg (1911): 823–830.

Communication préliminaire sur les résultats des travaux du levé magnétique du gouvernement de St. Pétersbourg de MM. E. A. Kučinsky, D. F. Nezdiurov et M. M. Rykačev. *Sketch-map.* [In Russian.]

Scandinavia. **Fulton.**

With ski in Norway and Lapland. By J. H. W. Fulton. London: P. Lee Warner, 1911. Size 8 × 5½, pp. xvi. and 254. *Sketch-map and Illustrations. Price 5s. Presented by the Publisher.*

Spain—Aragon. *Rev. G. Col. y Mercantil* **8** (1911): 326–334. **Briet and Prudent.**

Levantamientos hipsométricos en el Alto Aragón. Resultado de observaciones hechas con barómetro por Luciano Briet y calculadas por el Teniente Coronel Prudent.

The altitudes of over 200 points have been determined, the observations extending over the years 1907–10.

Spain—Galicia. **Hartley.**

Spain revisited; a summer holiday in Galicia. By C. Gasquoine Hartley (Mrs. Walter M. Gallichan). London: S. Paul & Co., 1911. Size 9 × 6, pp. 330. *Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Turkey—Albania—Geology. **Nopcsa.**

Zur Stratigraphie und Tektonik des Vilajets Skutari in Nordalbanien. Von Dr. Franz Baron Nopcsa. (Separat-Abdruck aus dem Jahrbuche der k.k. Geolog. Reichsanstalt, 1911, Bd. 61, 2 Heft.) Vienna, 1911. Size 10 × 7, pp. 230–284. *Sketch-map, Sections, and Illustrations.*

United Kingdom—Carnarvon. **Lloyd.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Carnarvonshire. By J. E. Lloyd. Cambridge: University Press, 1911. Size 7½ × 5, pp. xii. and 172. *Maps, Illustrations, and Diagrams. Price 1s. 6d. Presented by the Publishers.*

United Kingdom—Climate. *Quart. J.R. Met. S.* **37** (1911): 221–242. **Marriott.**

Variations in the English Climate during the thirty years 1881–1910. By William Marriott. *Tables and Diagrams.*

United Kingdom—Coast defence. **Stavenhagen.**

Die Küstenverteidigung des Britischen Weltreichs. Von Konigl. Hauptmann a. D. W. Stavenhagen. (Sonderabdruck aus: Jahrbücher für die deutsche Armee und Marine, No. 481, Oktober, 1911.) Berlin, [1911]. Size 9½ × 6, pp. 301–324. *Map.*

United Kingdom—Cornwall. *G. Teacher* **6** (1911): 90–103. **Carey.**

The Geography of Cornwall. By W. Maclean Carey. *Illustrations.*

United Kingdom—Geology. **Monckton and Herries.**

Geology in the field: the Jubilee volume of the Geologists' Association (1858–1908). Edited by H. W. Monckton and R. S. Herries. London: E. Stanford, [1909–] 1910. Size 9 × 6, pp. xxiv. and 916. *Maps, Illustrations, and Sections. Price* 20*s.* 6*d. net.*

United Kingdom—Isle of Man. **Quine.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). The Isle of Man. By Rev. John Quine. Cambridge: University Press, 1911. Size 7½ × 5, pp. x. and 178. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—London. **Bosworth.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). East London. By G. F. Bosworth. Cambridge: University Press, 1911. Size 7½ × 5, pp. x. and 256. *Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Monmouthshire. **Evans.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Monmouthshire. By Herbert A. Evans. Cambridge: University Press, 1911. Size 7½ × 5, pp. x. and 184. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented.*

United Kingdom—Scotland—Geology. **Clough and others.**

Memoirs of the Geological Survey, Scotland. The Geology of the Glasgow District. (Glasgow district map, including parts of sheets 30, 31, 22 and 23. By C. T. Clough and others.) Edinburgh, 1911. Size 9½ × 6, pp. x. and 270. *Sketch-maps, Sections, and Diagrams.*

United Kingdom—Scotland—Geology. **Gregory.**

T. Geol. S. Glasgow **14** (1909–10): 1–29.

Work for Glasgow Geologists. The Problems of the South-Western Highlands. By Prof. J. W. Gregory.

United Kingdom—Scotland—Geology. **Wallace.**

T. Dumfriesshire Nat. Hist. S. **22**, 1909–10 (1911): 128–137.

The Geology of the Cluden Basin and its Relation to the Scenery. By R. Wallace.

United Kingdom—Scotland—Place-names. **Dunlop.**

T. Dumfriesshire Nat. Hist. S. **22**, 1909–10 (1911): 20–24.

The Place Names of Irongray. By the Rev. S. Dunlop.

Irongray itself (in Galloway) is a corruption of Ard-an-greaich, "the height on the moor."

United Kingdom—Scotland—Plants. *Scottish G. Mag.* **27** (1911): 449–466. **Nisbet.**

The plant geography of Ardgoil. By Thomas Nisbet. *Maps and Illustrations.*

Ardgoil is the name lately given to the tract between Loch Long and Loch Goil, presented to the City of Glasgow by Mr. Cameron Corbett, M.P.

United Kingdom—Scotland—Population. **Chisholm.**

Scottish G. Mag. **27** (1911): 466–469.

Density of Population, Scotland, 1911. By Geo. G. Chisholm. *Map.*

United Kingdom—Wales. *Geol. Mag.* V. **8** (1911): 462–468. **Leach**

On the Relation of the Glacial Drift to the Raised Beach near Port Clais, St. Davids. By Arthur L. Leach. *Section.*

ASIA.

Arabia—Southern. **Bury.**

The Land of Uz. By Abdullah Mansûr (G. Wyman Bury). London: Macmillan & Co., 1911. Size 9 × 6, pp. xxviii. and 354. *Map and Illustrations. Price* 8*s.* 6*d. net. Presented by the Publishers.*

Asia—Ethnology. ———

Zap. Imp. Russian G.S., Ethnography **34** (1909): pp. viii. and 668.

Collection of papers in commemoration of the seventieth birthday of Gregory Nikolaevich Potanin. *Portrait, Map, and Illustrations.*

Nearly all the papers refer to manners, customs, etc., of the natives of various parts of Asiatic Russia.

Asia—Historical. *Zemleryedenie* **17** (1910): No. 2; 56–65. **Ditmar.**
"Wanderings through three Seas." Nikitin's journey to India, 1466. By B. Ditmar. *Sketch-maps.* [In Russian.]

China—Census. *Petermanns M.* **57** (1911): II.; 255–256. ——
Das Ergebniss der zweiten allgemeinen Volkszählung in China nach Familien. Aus dem Thronbericht des Chinesischen Ministeriums der inneren Verwaltung.

China—Weihaiwei. ——
Weihaiwei. Report on the Census, 1911. (Colonial Reports—Miscellaneous, No. 78, 1911.) London, 1911. Size 9½ × 6, pp. 22.
The total population was 147,177, including 215 Europeans.

China, Western. *La G., B.S.G. Paris* **24** (1911): 225–232. **Legendre.**
Exploration dans le Yun-nan et dans le Sseu-tch'ouan. Par le Dr. A. F. Legendre. *Sketch-maps.*
See note in the January number, p. 72.

Chinese Empire—Manchuria. *M. deuts. Ges. Ostasiens* **13** (1911): 157–179. **Thiess.**
Die Eisenbahnen der Mandschurei. Von Prof. Dr. K. Thiess.

Eastern Asia—Treaties. **Reinach.**
L. de Reinach. Recueil des traités conclus par la France en Extrême-Orient. Tome 2. (1901–1907.) Paris: E. Leroux, 1907. Size 10 × 6½, pp. 146. *Presented by Mdlle. de Reinach.*

French Indo-China—Historical. **Maspero.**
B. École française Extrême-orient. **10** (1910): 539–584, 665–682.
La Protectorat général d'Annam sous les T'ang. Essai de géographie historique. Par H. Maspero. *Map.*

French Indo-China—Waterways. **Pouyanne.**
B. Économique (Indo-China) **14** (1911): 614–642.
Les voies d'eau de la Cochinchine. Par A. Pouyanne.

India—Benares. **Havell.**
Benares the sacred city: sketches of Hindu life and religion. By E. B. Havell. 2nd edit. London: W. Thacker & Co., [1911]. Size 9 × 6, pp. xiv. and 226. *Illustrations. Price* 6*s.* 6*d. Presented by the Publishers.*

India—Bengal. *Mem. Asiatic S. Bengal* **3** (1911): 95–248. **La Touche.**
The journals of Major James Rennell. First Surveyor-General of India. Edited by T. H. D. La Touche. *Map and Facsimile.*
See Review in the December number, 1911, p. 610.

India—Burma—Language. **Bigg-Wither.**
A guide to the study of Shan. By Major F. Bigg-Wither. Rangoon, 1911. Size 9 × 5½, pp. xii. and 226. *Presented by the Author.*
Likely to be of much use to travellers in the Shan countries.

India—Ganges. *Ann. de G.* **20** (1911): 338–350. **Bonin.**
Une ancienne carte des sources du Gange. Par Ch. Eudes Bonin. *Facsimile Map.*
The map is that of Tieffenthaler published in 1784 by Anquetil Du Perron.

India—Goa. *B.S.G. Lisboa* **29** (1911): 43–46. **Luyten.**
1510–1910. Par le Chevalier Hugo Luyten.

India—Himalayan States. **Bonin.**
Charles-Eudes Bonin. Les royaumes des neiges (États himalayens). Paris: A. Colin, 1911. Size 7½ × 5, pp. x. and 306. *Sketch-maps and Illustrations. Price* 4 *fr. Presented by the Publisher.*

India—North-West Frontier. **Keppel.**
Gun-running and the Indian North-West Frontier. By the Hon. Arnold Keppel. London: John Murray, 1911. Size 9 × 5½, pp. xiv. and 214. *Sketch-maps and Illustrations. Price* 9*s. net. Presented by the Publishers.*

India—Waterways. *J.R. United Service I.* **55** (1911): 833–856, 977–996. **Bramley.**
The strategical and political value of the navigable waterways of India. By P. Bramley. *Sketch-map.*

Japan. **Porter.**
The full recognition of Japan: being a detailed account of the economic progress of the Japanese Empire to 1911. By Robert P. Porter. London: H. Frowde, 1911. Size 9½ × 6, pp. xii. and 790. *Maps. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Japan. *M.G. Ges. München* **6** (1911): 166–188. **Haushofer.**
Die geographischen Grundlagen der japanischen Wehrkraft. Von Major K. Haushofen. *Illustrations.*

Japan—Asama-yama. *J.G. Tōkyō G.S.* **23** (1911): 60–63. **Kobayashi.**
The Asama-yama eruption of December 2, 1910. By F. Kobayashi. *Illustration.* [In Japanese.]

Japan—Echigo. *J.G. Tōkyō G.S.* **23** (1911): 56–60. **Iki.**
Terraces of the Uwonuma District, Province Echigo. By T. Iki. [In Japanese.]

Japan—Esan. *J.G. Tōkyō G.S.* **23** (1911): 399–406. **Ōhikata.**
Esan Volcano and Esan Sulphur Mine. By J. Ōhikata. *Sketch-map.* [In Japanese.]

Japan—Formosa—Flora. **Hayata.**
J. College Sc. Imp. Univ. Tokyo **30** (Art. I.) (1911): pp. 472.
Materials for a Flora of Formosa. Supplementary notes to the 'Enumeratio Plantarum Formosanarum' and 'Flora Montana Formosæ,' based on a Study of the Collections of the Botanical Survey of the Government of Formosa, principally made at the Herbarium of the Royal Botanic Gardens, Kew. By B. Hayata.

Japan—Mineral springs. *J.G. Tōkyō G.S.* **23** (1911): 21–26. **Hiki.**
Distribution of mineral springs along the Geotectonic Lines in Central Japan. By T. Hiki. *Sketch-map.* [In Japanese.]

Japan—Volcano. *J.G. Tōkyō G.S.* **23** (1911): 312–319. **Kōzu.**
Norikura Volcano. By S. Kōzu. [In Japanese.]

Japan—Volcano. *J.G. Tōkyō G.S.* **23** (1911): 1–20. **Ōmori.**
Preliminary report on the eruption of Usu Volcano, 1910. By F. Ōmori. *Sketch-maps, Diagrams, and Illustrations.* [In Japanese.]

Korea—Iron ore. *J.G.Tōkyō G.S.* **23** (1911): 97–109. **Inouye.**
The Iron Ore of Korea. By K. Inouye. *Map.* [In Japanese.]

Malay Archipelago. **Elbert.**
Die Sunda-Expedition des Vereins für Geographie und Statistik zu Frankfurt am Main. Von Dr. Johannes Elbert. Band I. (Festschrift zur Feier des 75-jährigen Bestehens des Vereins.) Frankfurt a. M.: H. Minjon, 1911. Size 12 × 9, pp. xxvi. and 274. *Maps and Illustrations. Price* 35*m.*
The work is to be completed in two volumes.

Malay Archipelago—Borneo. *Sierra Club B.* **8** (1911): 18–24. **Foxworthy.**
A vacation trip to Mount Kinabalu in British North Borneo. By F. W. Foxworthy. *Illustrations.*

Malay Archipelago—Borneo. **Moulton.**
An expedition to Batu Lawi. By J. C. Moulton. (Extract from the *Sarawak Gazette*, vol. **41**, 1911.) Kuching, 1911. Size 11 × 8, pp. 148–151.
Batu Lawi is a lofty mountain never before visited by a white man (see Monthly Record, November, p. 530).

Malay Archipelago—Borneo. **Rutten and Rutten-Pekelharing.**
Ts. K. Nederl. Aardrijksk. Genoots., Ser. II., **28** (1911): 579–601.
De omgeving der Balikpapan-Baai. Door L. Rutten en C. J. Rutten-Pekelharing. *Map.*

Philippine Islands—Volcano. *B.G.S. Philadelphia* **9** (1911): 1–8. **Gilchrist.**
The recent volcanic eruption in the Philippines. By Charles A. Gilchrist. *Illustrations.*

Philippine Islands—Volcano. *B.G.S. Philadelphia* **9** (1911): 9–11. **MacClintock.**
A visit to the Great Taal Volcano. By Dr. Samuel MacClintock. *Illustrations.*

Philippine Islands—Volcano. *Philippine J. Sc.* **6** (1911): A, 87–93. **Martin.**
Observations on the recent eruption of Taal Volcano. By Charles Martin. *Illustrations.*

Philippine Islands—Volcano. *Philippine J. Sc.* **6** (1911): A, 63–86. **Pratt.**
The eruption of Taal Volcano, January 30, 1911. By Wallace E. Pratt. *Sketch-maps, Sections, and Illustrations.*
See note in the Monthly Record for October, p. 432.

Russia—Caucasus. *Petermanns M.* **57** (1911): 122–126. **Von Hahn.**
Die Nogaier im Gouvernement Stawropol (Ziskaukasien). Von K. v. Hahn.

Russia—Sakhalin. **Tikhonovich and Polevoi.**
B. Comité Geol. St. Pétersbourg **29** (1910): 715–754.
Les minerais utiles du Sachalin d'après les données de l'expedition de 1908–1910. Par N. Tikhonovitch et P. Polevoi. *Map.* [In Russian; German *résumé.*]

Russia—Siberia—Railway. **Verbluner.**
Travaux Sous-Sect. Troïtzkossawsk-Kiakhta, S. Imp. Russe G. **12** (1909): 11–40.
Project for a railroad between Misovska (Baikal) and Troïtzkosavsk-Kiakhta, with a note on its prolongation *viâ* Urga to Kalgan across Mongolia. By A. Werbluner (Verbliuner). *Map and Profile.* [In Russian.]

Turkey—Arabia. **Musil.**
Im nördlichen Heǧâz. Vorbericht über die Forschungsreise 1910, von Alois Musil. (Aus dem Anzeiger der philosophisch-historischen Klasse der kais. Akademie der Wissenschaften vom 17. Mai (Jahrgang 1911, Nr. XIII.).) Vienna, 1911. Size 9½ × 6, pp. 24. *Map.*
See note in the December number, p. 620.

Turkey—Armenia—Mount Ararat. *Le Tour du Monde* **17** (1911): 397–408. **Seylaz.**
L'Ascension du Mont Ararat. Par Louis Seylaz. *Illustrations.*
The ascent was made in 1910.

Turkey—Asia Minor. **Philippson.**
Petermanns M., Ergänzungsheft **172** (1911): pp. iv. and 100.
Reisen und Forschungen im westlichen Kleinasien. II. Heft: Ionien und das westliche Lydien. Von Dr. Alfred Philippson. *Map, Sections, and Illustrations.*

Turkey—Asia Minor. *M.V. Geographen Univ. Leipzig* **1** (1911): 36–56. **Sölch.**
Ueber ein wirkliches und ein angebliches Kanalprojekt im alten Bithynien. (Ein Beitrag zur historischen Geographie dieses Landes.) Von Dr. Johann Sölch.
On projects for the diversion of the Sakaria into Lake Sabanja, and this into the Gulf of Nicomedia, in Roman and Byzantine times.

Turkey—Mesopotamia. *Petermanns M.* **57** (1911): II. 126–130. **Pietschmann.**
Die österreichische Expedition nach Mesopotamien. Von Dr. V. Pietschmann.
Noticed in the Monthly Record, November, 1911, p. 529.

Turkey—Palestine. **Cohen.**
Zionist work in Palestine. By various authorities . . . edited by Israel Cohen. London: T. Fisher Unwin (on behalf of the Zionist Central Office), 1911. Size 8½ × 5, pp. 208. *Illustrations and Diagrams. Price 5s. net. Presented by the Publisher.*

Turkey—Palestine. **Franklin.**
Palestine, depicted and described, by G. E. Franklin. London: J. M. Dent & Sons, 1911. Size 9 × 6, pp. xx. and 222. *Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

Western Asia—Language. **Hassam.**
Arabic self-taught (Syrian), with English phonetic pronunciation. By A. Hassam; enlarged and revised by the Rev. N. Odeh. 4th edit. (Marlborough's Self-taught Series.) London: Marlborough & Co., 1911. Size 7½ × 5, pp. 128. *Illustrations. Price 2s. 6d. Presented by the Publishers.*

AFRICA.

Africa—Mines. **Mabson.**
The Statist's Mines of Africa. By R. R. Mabson. 1911–12 edit. London: "The Statist," [1911]. Size 7½ × 5, pp. xlii. and 892. *Maps and Plans. Price 21s. net. Presented by the Publishers.*

Central Africa—Boundary. *Deutsche Kolonialzeitung* **28** (1911): 607–608. **Moisel.**
Das neue Grenzabkommen zwischen Deutschland und Belgisch-Kongo im Kiwusee-Gebiet. Von M. Moisel. *Map and Illustrations.*
Cf. note in vol. **35**, p. 722.

Egypt—Avaris. *Cairo Sc. J.* **5** (1911): 234–235. **Stuart.**
The lost city of Avaris. By M. Villiers Stuart. *Plan.*
The writer places the ruins of this city at Tel el Hare, south-south-east of Port Said.

Egypt—Nubia. *Cairo Sc. J.* **5** (1911): 195–209. **Beckett.**
Nubia and the Berberine. By H. W. Beckett.
A sketch of the history of Nubia, followed by an account of the Barabra, with discussion of their affinities.

Egyptian Sudan—Gezira. *Cairo Sc. J.* **5** (1911): 181–189. **Beam.**
Soils of the Gezira. A preliminary note. By W. Beam. *Sketch-maps.*
The soils are considered from the point of view of possibilities of cultivation, whether rainfall or irrigation.

French West Africa. *Ann. de G.* **20** (1911): 155–178. **Hubert.**
Le relief de la Boucle du Niger. Par Henry Hubert. *Illustrations and Map.*

French West Africa. **Mugnier-Pollet.**
Renseignements Col., Afrique française (1911): 22–31.
De l'Adrar à la Baie du Lévrier. Par Lieutenant Mugnier-Pollet. *Sketch-map.*

German East Africa. *M.G. Ges. Hamburg* **25** (1911): 74–97. **Obst.**
Von Kilimatinde durch die Landschaft Turu nach Mkalama im Februar bis März 1911. Von Dr. E. Obst.

German East Africa. *M. Deutschen Schutzgeb.* **24** (1911): 182–187. **Prittwitz.**
Begleitworte zur Karte von Unjangwira. Von Major v. Prittwitz. *Maps.*

German East Africa. *M. Deutschen Schutzgeb.* **24** (1911): 188–192. **Prittwitz.**
Begleitworte zur Karte von Turu. Von Major v. Prittwitz. *Map and Illustrations.*

German East Africa—Railways. **Corsi.**
Istituto Coloniale Italiano: Biblioteca di studi coloniali, N. 13. Alberto Corsi. Costruzioni ferroviarie nell' Affrica Orientale Tedesca. Rome, 1911. Size 9½ × 6½, pp. 28. *Sketch-map and Illustrations.*

Kamerun. *M. Deutschen Schutzgeb.* **24** (1911): 55–112, 127–181. **Hassert.**
Das Kamerungebirge. Ergebnisse einer amtlichen Forschungsreise und literarischer Studien. Von Kurt Hassert. *Map and Diagrams.*

Kamerun. *Deutsches Kolonialblatt* **22** (1911): 660–665. **Winkler and Leyen.**
Berichte 1. des Oberleutnants Winkler über seine Erkundung des Mbam, und 2. des Oberleutnants v. der Leyen über seine Erkundung des Nun. *Map.*

Kamerun—Geology. *M. Deutschen Schutzgebieten* **24** (1911): 203–218. **Mann.**
Bericht über den Stand der geologischen Erforschung von Kamerun in Mai 1910. Von Dr. Otto Mann. *Map.*

Mashonaland—Zimbabwe. *Imp. Asiatic Quart. Rev.* **32** (1911): 110–121. **Edwards.**
The mystery of Zimbabwe. By Frederick A. Edwards.

Morocco. *B.S.G. Marseille* **34** (1910): 5–38. **Bardon.**
Notre Croisière du Maroc. Tanger-Casablanca—La Chaouia. (Mars-Avril, 1910.) Par M. H. Bardon.

Morocco. **Grasset.**
Captaine Grasset. A travers le Chaouïa avec le corps de débarquement de Casablanca (1907–1908). 2nd edit. Paris: Hachette & Cie., 1912 [1911]. Size 7½ × 5, pp. iv. and 232. *Sketch-map and Illustrations. Price 4 fr. Presented by the Publishers.*

Nigeria. **Morel.**
Nigeria: its peoples and its problems. By E. D. Morel. London: Smith, Elder & Co., 1911. Size 9½ × 6, pp. xviii. and 266. *Maps and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

Nigeria—Railway. *R. Engineers J.* **14** (1911): 221–230. **Hammond.**
The completion of the Baro-Kano Railway. By Captain F. D. Hammond.

Nile. *Ymer; Ts. Svenska S. Antropologi och. G.* **13** (1911): 126–152. **Lilienberg.**
Nilen och dess betydelse för Egypten. Af V. E. Lilienberg. *Sketch-map, Illustrations, and Diagrams.*

North Africa. **Grant.**
'Twixt sand and sea: sketches and studies in North Africa. By Cyril Fletcher Grant and L. Grant. London: S. Low, Marston & Co., 1911. Size 10 × 6½, pp. xii. & 504. *Sketch-map and Illustrations. Price 21s. net. Presented by the Publishers.*

Sahara. *Renseignements Col., Afrique Française* (1911): 167–178. **Cancel.**
A la poursuite des rezzous Marocains: Dans les ergs El-Atimine et Iguidi. Par Capitaine Cancel. *Portrait, Sketch-maps, and Illustration.*

Sahara. *B.S.G. Lille* **56** (1911): 162–182. **Cortier.**
Deux années dans le Sahara Central. Par le Capitaine Cortier. *Map and Illustrations.*

South Africa. **Brown.**
The guide to South and East Africa, for the use of tourists, sportsmen, invalids, and settlers. Edited annually by A. Samler Brown and G. Gordon Brown. 18th edit., 1911–1912. London: S. Low & Co., [1911]. Size 7½ × 5, pp. xliv. and 492. *Maps and Plans. Price 2s. 6d. Presented by the Union Castle Mail S.S. Co.*

South Africa—Pans. *Petermanns M.* **57** (1911) II.: 57–61, 130–135. **Passarge.**
Die pfannenförmigen Hohlformen der Südafrikanischen Steppen. Von Dr. S. Passarge. *Sections.*
Noticed in the Monthly Record, October, 1911, p. 432.

South Africa—Vegetation. **Brunnthaler.**
Vegetationsbilder (ed. Karsten and Schenck) **9** (1911): Plates 19–30.
Vegetationsbilder aus Südafrika (Karroo und Dornbusch). Von Josef Brunnthaler.

Sudan—Language. **Fletcher.**
Hausa sayings and folk-lore, with a vocabulary of new words. Compiled and edited by Roland S. Fletcher. Oxford: H. Frowde, 1912. Size 7½ × 5, pp. 174. *Price 8s. 6d. Presented by the Publisher.*

Togo and Dahome—Boundary. *M.G. Ges. München* **6** (1911): 1–18. **Seefried.**
Die Togo—Dahomey Grenzvermessungs-Expedition nebst Mitteilungen über Togo. Von Hauptmann Freiherrn A. von Seefried auf Buttenheim. *Illustrations.*

Tripoli—Minerals. *L'esplorazione Com.* **26** (1911): 363–373. **Giannò.**
I bacini minerarii della Tripolitania. Del Dott. Salvatore Giannò. *Sketch-maps and Illustrations.*

Uganda—Ethnology. **Fisher.**
Twilight tales of the black Baganda. By Mrs. A. B. Fisher. London: Marshall Bros., 1911. Size 9 × 6, pp. x. and 198. *Illustrations. Price 3s. 6d. net. Presented by the Publishers.*

NORTH AMERICA.

Canada—Ontario—Historical. **Jones.**
"Sendake Ehen," or old Huronia. By Arthur Edward Jones, S.J. (Fifth Report of the Bureau of Archives for the Province of Ontario. 1908.) Toronto, 1909. Size 10 × 6½, pp. xxxii. and 506. *Maps, Plans, and Illustrations. Presented by the Author.*

Canada—Place-names. **White.**
Place-names in Quebec. By James White. Place-names in the Thousand Islands, St. Lawrence River. By the same. Place-names in Northern Canada. By the same. (Ninth Report of the Geographic Board of Canada, Parts 2–4.) [Ottawa, 1911.] Size 10 × 7, pp. 153–456. *Map. Presented by the Author.*

Labrador—Game Reserves. **Wood.**
Commission of Conservation, Canada. Animal Sanctuaries in Labrador. An address presented by Lieut.-Colonel William Wood. Ottawa, 1911. Size 9½ × 6½, pp. 38.
A vigorous appeal for measures to rescue the wild life of Labrador from extermination.

Mexico—Volcanoes. *Sierra Club B.* **8** (1911): 96–109. **Poindexter.**

Four Mexican Volcanoes. By R. W. Poindexter. *Illustrations.*

United States—California. *J.G.* **9** (1911): 253–261. **Chamberlin.**

Geographic influences in the development of California. By James F. Chamberlin.

United States—California. *J.G.* **9** (1911): 261–265. **Holway.**

Topographic environment of San Francisco. By Ruliff S. Holway.

United States—Climate. **Day.**

U.S. Department of Agriculture, Weather Bureau Bulletin V. Frost data of the United States; and length of the crop-growing season, as determined from the average of the latest and earliest dates of killing frost. By P. C. Day. Washington, 1911. Size 12 × 9, pp. 6. *Maps.*

See note in the Monthly Record (vol. 38, p. 626).

United States—Climate. **Weather Bureau.**

U.S. Department of Agriculture, Weather Bureau Bulletin U. Temperature departures, monthly and annual, in the United States, January, 1873, to June, 1909, inclusive. Washington, 1911. Size 12 × 9. *Maps (only).*

United States—Climatology. **Arctowski.**

La dynamique des anomalies climatiques. Contribution à l'étude des changements de la répartition de la pression atmosphérique aux Etats-Unis. Par H. Arctowski. (From *Prac Matematyczno-Fizycznych*, Tom. xxi.) Warsaw, 1910. Size 10 × 7, pp. 179–196. *Sketch-maps and Diagrams.*

United States—Coast defence. **Stavenhagen.**

Die Küstenverteidigung der Vereinigten Staaten Amerikas. Von königl. Hauptmann a. D. W. Stavenhagen. (Sonderabdruck aus den *Mitteilungen über Gegenstände des Artillerie- und Geniewesens*, Jahrgang 1911, zehntes Heft.) Vienna, 1911. Size 9½ × 6, pp. 14. *Sketch-maps.*

United States—Colorado. *J. Geology* **19** (1911): 449–453. **Atwood.**

Physiographic studies in the San Juan district of Colorado. By Wallace W. Atwood.

United States—Colorado. *Science* **34** (1911): 89–91. **Robinson.**

The single cycle development of the Grand Canyon of the Colorado. By H. H. Robinson.

United States—Commercial. *B. American G.S.* **43** (1911): 500–509. **Surface.**

Rice in the United States. By Dr. G. T. Surface. *Sketch-maps and Illustrations.*

United States—Forests. **Bowman.**

Forest physiography: physiography of the United States and principles of soils in relation to forests. By Dr. Isaiah Bowman. New York: J. Wiley & Sons. (London: Chapman & Hall), 1911. Size 9½ × 6, pp. xxii. and 760. *Maps, Illustrations, and Diagrams. Price 21s. net. Presented by the Author.*

United States—Gravity. *American J. Sc.* **32** (1911): 101–113. **Bowie.**

Recent Gravity Work in the United States. By William Bowie.

United States—Hydrology. **Stabler.**

U.S. Geol. Surv. Water-Supply Paper 274 (1911): pp. 188.

Some stream-waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses. By Herman Stabler.

United States—Meteorology. **Bigelow.**

U.S. Department of Agriculture; Weather Bureau, Bulletin S. Report on the temperatures and vapor tensions of the United States, reduced to a homogeneous system of twenty-four hourly observations for the thirty-three year interval, 1873–1905. Prepared . . . by Frank H. Bigelow. Washington, 1909. Size 12 × 9, pp. 302. *Maps.*

United States—Michigan. *J.G.* **10** (1911): 37–44. **Parkins.**

The Railroads, Industries and Distribution of Population in Michigan. By A. E. Parkins. *Sketch-maps.*

United States—Minnesota. **Hall and others.**

U.S. Geol. Surv. Water-Supply Paper 256 (1911): pp. 406.

Geology and underground waters of Southern Minnesota. By C. W. Hall, O. E. Meinzer, and M. L. Fuller. *Maps, Diagrams, and Sections.*

United States—North Carolina. **Brown.**
U.S. National Museum, Contributions from National Herbarium **13** (1911): 323–341.
The plant life of Ellis, Great, Little, and Long Lakes in North Carolina. By William H. Brown. *Diagram.*

United States—Rockies—Snow. *Monthly Weather Rev.* **39** (1911): 738–761. **Alter.**
Where the snow lies in summer. By J. Cecil Alter. *Illustrations.*

United States—Waterways. *B. American G.S.* **43** (1911): 573–586. **Brown.**
A Review of the Waterway Problem. By Robert Marshall Brown.

United States—Wisconsin. **Cox.**
U.S. Department of Agriculture; Weather Bureau, Bulletin N. Frost and temperature conditions in the cranberry marshes of Wisconsin. By Henry J. Cox. Size 12 × 9, pp. 122. *Sketch-map, Illustrations, and Diagrams.*

United States—Wisconsin. *B.G.S. Philadelphia* **9** (1911): 12–21. **Whitbeck.**
Contrasts between the glaciated and the driftless portions of Wisconsin. By R. H. Whitbeck. *Sketch-maps.*

CENTRAL AND SOUTH AMERICA.

Central and South America. **"Vaquero."**
Adventures in search of a living in Spanish America. By "Vaquero." London: J. Bale, Sons, & Danielsson, 1911. Size 10 × 6½, pp. viii. and 304. *Sketch-maps and Illustrations. Price* 8*s.* 6*d. net. Presented by the Publishers.*

Guatemala—Archæology. *Mem. Peabody Museum* **5** (1911): 1–92. **Maler.**
Explorations in the department of Peten, Guatemala. By Teobert Maler. *Plans, Illustrations, and Sections.*

Guatemala—Archæology. *Le Tour du Monde* **17** (1911): 349–360. **Périgny.**
Villes mortes de l'Amérique centrale. Les ruines de Nakcun. Par le Comte Maurice de Périgny. *Sketch-map and Illustrations.*

Guatemala—Archæology. *Mem. Peabody Museum* **5** (1911): 93–135. **Tozzer.**
A preliminary study of the prehistoric ruins of Tikal, Guatemala. A report of the Peabody Museum Expedition, 1909–10. By Alfred M. Tozzer. *Plans, Sections, and Illustrations.*

Guiana. *Timehri* (*Georgetown*) **1** (1911): 89–97. **McTurk.**
My journey from Kalacoon to the Orinoco. By M. McTurk. *Portrait.*

Guiana—Historical. **Ijzerman.**
Ts. K. Nederl. Aardrijksk. Genoots. II. Ser. **28** (1911): 648–661.
Twee reizen van Paramaribo, een naar de Parima in 1718 en een naar de Boven Corantijn in 1720. Door J. W. Ijzerman. *Sketch-map.*
See note in the Monthly Record, January, p. 76.

Panama. **Edwards.**
Panama: the canal, the country, and the people. By Albert Edwards. New York: The Macmillan Co. [London: Macmillan & Co.], 1911. Size 8 × 5½, pp. x. and 586. *Sketch-maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Panama Canal. **Isthmian Canal Commission.**
Official Handbook of the Panama Canal. Second edition, revised and enlarged. Compiled by the Secretary of the Isthmian Canal Commission. Ancon, 1911. Size 9½ × 5, pp. 30. *Sketch-maps, Plans, and Diagrams.*

Paraguay. **Macdonald.**
Picturesque Paraguay. By Alexander K. Macdonald. London: C. H. Kelly, [1911]. Size 8½ × 6½, pp. 498. *Illustrations. Price* 16*s. net. Presented by the Publisher.*

Porto Rico—Climate. **Fassig.**
U.S. Department of Agriculture, Weather Bureau. The climate of Porto Rico. By Dr. Oliver L. Fassig. [Washington, 1910.] Size 12 × 9½, pp. 12. *Diagrams and Charts.*
Noticed in the Monthly Record **vol. 38**, p. 627.

Titicaca. *B. Ofic. Nacional Estadistica, Bolivia* (1911): 156–163. **Sundt.**
El Lago Titicaca. Por Lorenzo Sundt.

Venezuela—Survey. **Ministerio de Relaciones Interiores.**
Appendice á la Ministerio de Relaciones Interiores. Trabajos del Cuerpo de Ingenieros, encargado del levantamiento del Mapa Fisico y Politico de Venezuela. Caracas, 1911. Size 10½ × 7½, pp. xxxiv. and 486. *Maps, Diagrams, and Illustrations.*

West Indies. *Petermanns M.* 57 (1911) [i.]: 125–127, 180–184. **Sapper.**
Die wirtschaftlichen Verhältnisse der Kleinen Antillen. Von Prof. Dr. Karl Sapper. *Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Melanesia—Ethnology. **Thurnwald.**
Stufen der Staatsbildung bei den Urzeitvölkern auf Grund von Forschungen bei den melanesischen Stämmen der Südsee. Von Dr. Richard Thurnwald. (Sonderabdruck aus *Zeitschrift für vergleichende Rechtswissenschaft*, XXV. Bd.) Stuttgart, [1911]. Size 8½ × 5½, pp. 417–432.

New Guinea—Dutch. *Ts. K. Ned. Aardr. Genoots.* 28 (1911): 823–833. ——
De exploratie van Ned. Nieuw-Guinea. *Map.*
Reports on various expeditions. The map shows the surroundings of Lake Sentani, explored by Captain Sachse.

New Pomerania—Volcanoes. *Petermanns M.* 59 (1911) II.: 135–139. **Sapper.**
Die Tätigkeit der Vulkane Ghaio und Raluan (Neupommern). Von Prof. Dr. Karl Sapper. *Sketch-map.*
See note in the October number, p. 434.

New Zealand—Bush. *T. and P. New Zealand I.* 43 (1910–11): 436–447. **Walsh.**
The Effects of Disappearance of the New Zealand Bush. By Archdeacon Walsh.

New Zealand—Canterbury. **Speight.**
T. and P. New Zealand I. 43 ((1910–11): 315–378.
The Mount Arrowsmith District: a Study in Physiography and Plant Ecology. By R. Speight. *Sketch-maps and Illustrations.*

New Zealand—Glaciation. *T. and P. New Zealand I.* 43 (1910–11): 520–524. **Park.**
Some Notes on the Marlborough Coastal Moraines and Waiau Glacial Valley. By Prof. James Park. *Sketch-map.*

New Zealand—Nelson. *T. and P. New Zealand I.* 43 (1910–11): 306–315. **Henderson.**
On the Genesis of the Surface Forms and Present Drainage-systems of West Nelson. By J. Henderson.

New Zealand—North Island. *T. and P. New Zealand I.* 43 (1910–11): 287–296. **Hill.**
Napier to Runange and the Taupo Plateau. By H. Hill. *Sketch-map and Section.*

New Zealand—Rotomahana. *T. and P. New Zealand I.* 43 (1910–11): 278–287. **Hill.**
Rotomahana and District revisited Twenty-three Years after the Eruption. By H. Hill.

New Zealand—Vegetation. **Cockayne.**
On the peopling by plants of the subalpine river-bed of the Rakaia (Southern Alps of New Zealand). By Dr. L. Cockayne. (Reprinted from *Transactions and Proceedings of the Botanical Society of Edinburgh*, vol. 24, part iii.) [Edinburgh, 1911.] Size 8½ × 5½, pp. 104–125. *Illustrations.*
Noticed in the November number, 1911, p. 535.

New Zealand—Wellington—Geology. **Adkin.**
T. and P. New Zealand I. 43 (1910–11): 496–520.
The Post-tertiary Geological History of the Ohau River and of the Adjacent Coastal Plain. Horowhenua County, North Island. By George Leslie Adkin. *Sketch-maps, Sections and Illustrations.*

Pacific Islands. **Burnett.**
Through Polynesia and Papua: wanderings with a camera in Southern Seas. By Frank Burnett. London: F. Griffiths, 1911. Size 9 × 6, pp. xvi. and 198. *Sketch-map and Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

Pacific—Polynesia. **Caillot.**
Histoire de la Polynésie orientale. Par A. C. Eugéne Caillot. Paris: E. Leroux, 1910. Size 10 × 6½, pp. 606. *Illustrations. Presented by the Publisher.*

Queensland—Vegetation. *P.R.S. Queensland* **23** (1911): 57–74. **Domin.**

Queensland's Plant Associations. (Some Problems of Queensland's Botanogeography.) By Dr. Karel Domin.

Samoa—Native law. **Schultz.**

Samoanisches Familien-, Immobiliar- und Erbrecht. Von Dr. E. Schultz. Dritte Auflage. Apia, 1911. Size 8½ × 5½, pp. 44. *Presented by the Author.*

POLAR REGIONS.

Greenland—Disco Island. *Beiträge z. Geophysik* **11** (1911): Kl. M. 9–28. **Harboe.**

Das Erdbebenobservatorium auf der Disko-Insel. Von E. G. Harboe. *Diagrams.*

Spitsbergen—Geomorphology. **Drygalski.**

Abh. K.A. W. München, Math.-phy. Kl. **25** (1911): Abh. 7, pp. 62.

Spitzbergens Landformen und ihre Vereisung. Von Erich von Drygalski. *Illustrations and Sections.*

Spitsbergen—Glaciation. *P.R. Irish A.* **29**, Sec. B (1911): 191–208. **Cole.**

Glacial features in Spitsbergen in relation to Irish geology. By Grenville A. J. Cole. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Nautical Almanac. **Brown and Goodwin.**

Brown's Nautical Almanac, Harbour and Dock Guide and Daily Tide Tables for 1912. Edited by James R. Brown, assisted by H. B. Goodwin. London: James Brown & Son, [1911]. Size 8½ × 5½, pp. 80 and 592. *Charts.*

Navigation—Steam-ships. **Ruthven.**

Speed and consumption of steam-ships, with algebraic formula for economical speed and rules for calculating the alterations in draught and trim corresponding to changes in displacement, and for using the hydrometer to estimate those due to differences in the specific gravity of the water. To which has been added a chapter on stability, with practical rules. By J. F. Ruthven. London: J. D. Potter, 1911. *Size 9½ × 6, pp. 78. *Diagrams. Price 4s. Presented by the Author.*

Position-fixing. *C.R.A. Sc. Paris* **153** (1911): 497–500. **Bourgeois.**

Détermination des co-ordonnées géographiques aux colonies en employant la télégraphie sans fil. Essai de la méthode entre Paris (Observatoire) et Bruxelles (Palais de Laeken). Par M. Bourgeois.

Surveying. **Nugent.**

Plane surveying. A text and reference book for the use of students in engineering and for engineers generally. By Paul C. Nugent. 3rd edit. New York (London: Chapman & Hall), 1911. Size 9½ × 6, pp. xxii. and 600. *Maps, Plans, and Diagrams. Price 15s. net. Presented by the Publishers.*

Surveying—Errors. *T.R.S. Edinburgh* **47** (1910–11): 849–877. **Briggs.**

An Investigation into the Effects of Errors in Surveying. By Henry Briggs. *Diagrams.*

Tables. *Smithsonian Misc. Coll.* **58** (1910): No. 1, pp. xxxiv. and 318. **Fowle.**

Smithsonian physical tables. (Fifth revised edition.) Prepared by F. E. Fowle.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Dorno.**

Studie über Licht und Luft des Hochgebirges. Von Dr. C. Dorno. Brunswick: F. Vieweg und Sohn, 1911. Size 13½ × 10, pp. viii. and 154. *Illustrations and Diagrams. Price 20m. Presented by the Publishers.*

Geology. **Haug.**

Émile Haug. Traité de géologie. II. Les périodes géologiques. Paris: A. Colin, 1908–1911. Size 10 × 6½, pp. 539–2024. *Sketch-maps, Illustrations, and Diagrams. Price 30 fr. Presented by the Publisher.*

Geomorphology—Atlas. **Brunhes, Chaix, and Martonne.**

Atlas photographique des formes du relief terrestre. Documents morphologiques caractéristiques avec notices scientifiques, publiés conformement à un vœu du IX^e^ Congrès International de Géographie, sous les auspices d'une Commission internationale permanente, par J. Brunhes, E. Chaix et Emm. de Martonne. Fascimile-specimen. Geneva: F. Boissonnas et Cie, [1911]. Size 13 × 10: | 8 *Plates (with descriptions).*

See notice at p. 141, *ante.*

Isostasy. *P. America Phil. S.* **50** (1911): 444–451. **Reid.**
Isostasy and Mountain Ranges. By Harry Fielding Reid.

Lakes—Temperature. *M.V. Geographen Univ. Leipzig* **1** (1911): 79–91. **Merz.**
Die Sprungschichte der Seen. Von Dr. Alfred Merz. *Also separate copy.*

Lakes—Temperature. **Wedderburn and Williams.**
T.R.S. Edinburgh **47** (1910–11): 619–642.
The Temperature Seiche. Part I. Temperature Observations in the Madüsee, Pomerania. Part II. Hydrographical Theory of Temperature Oscillations in Lakes. Part III. Calculation of the Period of the Temperature Seiche in the Madüsee. By E. M. Wedderburn. Part IV. Experimental Verification of the Hydrodynamical Theory of Temperature Seiches. By E. M. Wedderburn and A. M. Williams. *Sketch-map and Diagrams.*
A note on the observations on which the above was based was given in vol. **37**, p. 313.

Magnetism. **Leyst.**
Die Variationen des Erdmagnetismus. Von Prof. Dr. Ernst Leyst. Moscow, 1910. Size 10 × 6½, pp. 252. *Diagrams.*

Magnetism. **Leyst.**
Ueber erdmagnetische Ablenkungsbeobachtungen. Von Prof. Dr. Ernst Leyst. Moscow, 1910. Size 10 × 6½, pp. 134. *Diagrams.*

Meteorology. *Ann. de G.* **20** (1911): 305–310. **Baulig.**
Observations météorologiques du "François Arago" au large de Terre Neuve. Par H. Baulig. *Diagrams.*
The observations were made during the summer of 1910.

Meteorology—Pressure. *B. Mount Weather Observatory* **4** (1911): 1–12. **Humphreys.**
Origin of the permanent ocean highs. By W. J. Humphreys. *Charts and Diagram.*

Meteorology—Rainfall. *Quart. J.R. Met. S.* **37** (1911): 209–220. **Turner.**
What can we learn from rainfall records? By Prof. H. H. Turner.

Meteorology—Temperature. *Met. Z.* **28** (1911): 301–306. **Liznar.**
Mitteltemperaturen der Breitenkreise und mittlere Temperatur einer Land- bzw. Wasserhemisphäre sowie der ganzen Erde. Von J. Liznar.

Meteorology—Upper air. *G.Z.* **17** (1911): 310–331. **Peppler.**
Die Fortschritte in der Erforschung der freien Atmosphäre während des letzten Dezennium. Von A. Peppler. *Diagrams.*

Oceanography—Arctic ocean. *Ann. Hydrographie* **39** (1911): 301–303. **Reichard.**
Hydrographische Beobachtungen der schwedischen Expedition nach Spitzbergen 1908. Von A. C. Reichard.

Oceanography—North sea. **Mielck.**
Quantitative Untersuchungen an dem Plankton der deutschen Nordsee-Terminfahrten im Februar und Mai 1906. Von W. Mielck. (Arbeiten der Deutschen wissenschaftlichen Kommission für die Internationale Meersforschung: B., Aus dem Laboratorium für internationale Meeresforschung in Kiel; Biologische Abteilung, No. 21.) Kiel, 1911. Size 12½ × 10½, pp. 315–357. *Chart.*

Oceanography—Pacific. *Ann. Hydrographie* **39** (1911): 521–527. **Dominik.**
Temperatur- und Salzgehaltsbestimmungen im südwestlichen Stillen Ozean, 1910. Nach den Berichten S.M.S. *Planet*, Kommandant K.-Kapt. Dominik. *Sketch-map and Diagrams.*

Oceanography—Pacific. *J.G. Tōkyō G.S.* **23** (1911): 200–204. **Ohara**
Oceanic Current along the North-western part of Bonin islands. By T. Ōhara. [In Japanese.]

Oceanography—Tides and currents. **Dawson.**
P. and T.R.S. Canada **4** (1910–11): Sect. III., 3–17.
Methods of Investigation of Tides and Currents: A review of the general methods adopted in a new field of investigation, by the Tidal Survey of Canada. Presidential address by Dr. W. Bell Dawson.

Physical Geography—Maps. **Dwerryhouse.**
Geological and topographical maps: their interpretation and use. A handbook

for the geologist and civil engineer. By Dr. Arthur R. Dwerryhouse. London: E. Arnold, 1911. Size 9 × 5½, pp. vi. and 134. *Maps, Sections, and Diagrams. Price 4s. 6d. net. Presented by the Publisher.*

Seismology. **Montessus de Ballore.**

Comte de Montessus de Ballore. La sismologie moderne: les tremblements de terre. Paris: A. Colin, 1911. Size 7½ × 5, pp. xx. and 284. *Maps, Illustrations, and Diagrams. Price 4 fr. Presented by the Publisher.*

Snow-forms. *Zemlevyedenie* **17** (1910): No. 3: 35–48. **Polinof.**

On permanent frost and the forms of perennial snow and ice in the Amur Province. By B. Polinof. *Illustrations.* [In Russian.]

Waterfalls. *Scottish G. Mag.* **27** (1911): 537–546. **Gregory.**

Constructive Waterfalls. By Prof. J. W. Gregory. *Sketch-maps and Sections.*

Shows, from examples in Dalmatia and Bosnia, that waterfalls may sometimes reverse their usual destructive action (see November number, p. 507).

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Ann. de G.* **20** (1911): 289–304. **Vidal de la Blache.**

Les genres de vie dans la Géographie humaine (*seconde article*). Par P. Vidal de la Blache.

Colonisation. **Lannoy and Van der Linden.**

Charles de Lannoy et Herman Van der Linden. Histoire de l'expansion coloniale des peuples européens. Néerlande et Danemark (XVII^e^ et XVIII^e^ siècles). Brussels: H. Lamertin, 1911. Size 9 × 6, pp. vi. and 488. *Sketch-maps. Price 8 fr. Presented.*

Commercial. **Andree.**

Karl Andrees Geographie des Welthandels, vollständig neu bearbeitet von einer Anzahl von Fachmännern und herausgegeben von Dr. Franz Heiderich und Dr. Robert Sieger. II. Band. Frankfurt a. M., H. Keller, 1911. Size 10 × 7, pp. viii. and 920. *Maps. Price 14s. 6d.*

Commercial—Cables. *Z. Kolonialpolitik* **13** (1911): 655–683. **Stahl.**

Der deutschen Kabel, nebst einleitendem Ueberblick über die Kabellinien des Weltverkehrs. Von Dr. Wilhelm Stahl.

Commercial Geography. **Redway.**

Commercial geography: a book for High Schools, commercial courses, and business colleges. Revised edition. By Jacques W. Redway. New York: C. Scribner's Sons, 1911. Size 8 × 5½, pp. x. and 424. *Maps and Illustrations. Presented by the Publishers.*

Commercial Geography—Cables. *United Empire* **2** (1911): 541–552, 622–632. **Bright.**

Imperial Telegraphs. By Charles Bright. *Map. Also separate copy,* size 9½ × 6½, pp. 22. *Map.*

Commercial—Mining. *Scottish G. Mag.* **27** (1911): 417–426, 470–474. **Hubbard.**

Gold and Silver mining and reduction processes as responses to geographic conditions. By George D. Hubbard.

Commercial—Rubber. **Torrey and Manders.**

The rubber industry. Being the Official Report of the Proceedings of the International Rubber Congress, London, 1911, held at the National Rubber and Allied Trades Exhibition, 24th June to 14th July. Edited by Dr. Joseph Torrey and A. Staines Manders. London: published by the Exhibition, [1911]. Size 10 × 6, pp. 470. *Sketch-maps and Illustrations. Price 15s. 6d. Presented by the Editors.*

Historical—Wineland. **Fernald.**

Notes on the plants of Wineland the good. By M. L. Fernald. (Reprinted from *Rhodora:* Journal of the New England Botanical Club, vol. **12**, No. 134, February, 1910.) [Cambridge, Mass.], 1910. Size 9 × 6, pp. 17–38.

This is one of the papers referred to by Dr. Grenfell in the *Journal*, vol. **37**, p. 409.

History of Navigation. *J.R. United Service I.* **55** (1911): 1205–1208. **Corney.**

The Xebec. By B. Glanvill Corney. *Illustration.*

Description of this coasting vessel of the Mediterranean.

BIOGRAPHY.

Peyssonnel. *B.S.G. de L'est* **32** (1911): 5–15. **Rampal.**
Les Manuscrits du Voyageur Jean-André Peyssonnel. Par Auguste Rampal.

GENERAL.

Statistics. **Birot.**
Statistique annuelle de géographie humaine comparée 1911. Par Jean Birot. Paris: Hachette et Cie., 1911. Size 8½ × 5½, pp. 32.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**
Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1911.

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(E. Stanford, London Agent.)

British Isles—London. **Bartholomew.**
Bartholomew's Plan of London: North-west Section. Scale 1:19,495 or 3·25 inches to 1 stat. mile. Edinburgh: John Bartholomew & Co., [1911].

British Isles—Scotland. **Bartholomew.**
Bartholomew's "Quarter-inch to mile" Map of Scotland. Sheet 1. Sutherland and Caithness. Edinburgh: John Bartholomew & Co., 1911. *Price* 2*s. net, mounted on cloth. Presented by the Publishers.*

Europe. **Unstead and Taylor.**
Philips' Comparative Series of Wall Atlases. Edited by J. F. Unstead, M.A., and E. G. R. Taylor, B.SC., with explanatory Handbook for Teachers. Europe. Scale 1:6,000,000 or 1 inch to 94·7 stat. miles. 1, Relief of land and communications; 2, Political; 3, Climate, summer conditions; 4, Climate, winter conditions; 5, Temperature; 6, Natural vegetation; 7, Economic; 8, Density of population. London: George Philip & Son, Ltd., 1911. *Price* 27*s.* 6*d. the set. Presented by the Publishers.*

These eight maps of Europe form the first set of a new series of school wall-maps now in course of publication. They are all on the same scale, and measure 33 inches by 41 inches. The chief geographical facts of the continent are exhibited in a bold manner by colours and symbols. In some instances, such as that of the vegetation map, the colours might perhaps have been improved, but on the whole they are effective, and in the hands of a capable teacher the maps cannot fail to add considerably to the interest and instruction of the lesson. To give any proper idea of cause and effect in geographical distribution, it is necessary to have recourse to some such series, and doubtless teachers will find these maps very useful. Perhaps they are hardly large enough for class instruction, and they certainly would not be seen well across a room of any great size. It is proposed to deal with all the continents in the same manner, and the series for Asia is already in preparation. The maps are mounted on linen, and when not in use are intended to be folded in a case. An explanatory handbook will accompany each series.

France. **Frater.**
Carte de la Frontière Nord-Est de la France. Par le Colonel Frater. 10ᵉ Édition. Scale 1:864,000 or 1 inch to 13·6 stat. miles. Paris: Chapelot & Cie., 1912.

Holland. **Kuijper.**

Drenthe, scale 1 : 170, 000 or 1 inch to 2·6 stat. miles; Friesland, scale 1 : 180,000 or 1 inch to 2·8 stat. miles; Gelderland, scale 1 : 250,000 or 1 inch to 3·9 stat. miles; Groningen, scale 1 : 178,500 or 1 inch to 2·8 stat. miles; Noord Brabant, scale 1 : 250,000 or 1 inch to 3·9 stat. miles; Noord Holland, scale 1 : 240,000 or 1 inch to 3·7 stat. miles; Overijssel, scale 1 : 200,000 or 1 inch to 3·2 stat. miles; Utrecht, scale 1 : 115,000 or 1 inch to 1·8 stat. mile; Zeeland, scale 1 : 165,000 or 1 inch to 2·6 stat. miles; Zuid Holland, scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Outworpen en getreekend door J. Kuijper. Zwolle: W. E. J. Tjeenk Willink, 1908–1911.

Switzerland. **Commission Géologique Suisse.**

Carte géologique de la Suisse publiée par la Commission Géologique de la Société Helvetique des Sciences Naturelles. Spezialkarte No. 55, Geologische Kart des Gebirges zwischen Engelberg und Meiringen. Aufgenomen von Paul Arbenz 1905–1909. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Carte Spéciale No. 59, Carte geologique des Environs du Locle et de La Chaud-de-Fonds par Louis Rollier et Jules Favre. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Bern: A. Francke, 1911. *Presented by the Swiss Geological Commission.*

Turkey. **Diest and Groll.**

Das Osmanische Reich und seine Nachbarländer, bearbeitet von W. von Diest und Dr. M. Groll. Scale 1 : 10,000,000 or 1 inch to 157·8 stat. miles. Berlin: Gea verlag G. m. b. H., 1911.

ASIA.

Malay Peninsula. **Survey Office, Kuala Lumpur.**

Selangor, Federated Malay States. Scale 1 : 126,720 or 1 inch to 2 stat. miles. 4 sheets. Kuala Lumpur; Central Survey Office, 1910. *Presented by the Surveyor-General, Federated Malay States.*

A new edition of a map which appeared first in 1904. The latest surveys have been utilised in the revision, and the map gives a considerable amount of information concerning boundaries of agricultural and mining lands, forest and other reserves, roads, telegraphs, and matters of a kindred nature. It is in four sheets, each of which measures 27 inches by 24 inches.

AFRICA.

Africa. **Agostini.**

Carta Politica dell' Africa. Scale 1 : 34,000,000 or 1 inch to 378·7 stat. miles. Novara: Istituto Geografico de Agostini, [1911]. *Price 0·60l. Presented by the Publishers.*

Africa. **Geographical Section, General Staff.**

Map of Africa. Drawn and printed at the Geographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: North A 36–N, Hoima; North A 36–U, Entebbe. London: Edward Stanford, Sifton Praed, T. Fisher Unwin, 1911. *Price 2s. net each sheet. Presented by the Director of Military Operations.*

Africa. **Geographical Section, General Staff.**

Africa. Drawn and printed at the Geographical Section, General Staff, War Office. Scale 1 : 125,000 or 1 inch to 1·9 stat. mile. Sheet: South A 37–AIV. Nianʻarawa, East Africa Protectorate. London: E. Stanford, Sifton Praed, T. Fisher Unwin, 1911. *Price 2s. net each sheet. Presented by the Director of Military Operations.*

Algeria. **Service Géographique de l'Armée, Paris.**

Carte de l'Algérie. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Sheets: 12, Orléansville; 14, Médéa; 16, Sétif; 22, Ammi Moussa; 30, Nemours; 31, Tlemcen; 44, El Ousseukr; 48, Biskra; 49, Sidi Okba. Paris: Service Géographique de l'Armée, 1911. *Price 0·70 fr. each sheet.*

Kamerun. **Reimer.**

Die Neugestaltung Kamerun auf Grund des Marokko-Abkommens. Mit Darstellung der Grenzen der französischen Konzessions-Gesellschaften und der Freihandelszone. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. Berlin: Dietrich Reimer (Ernst Vohsen), 1911.

A bold diagrammatic map showing the new territorial arrangement between France and Germany in West Africa.

Lagos. **Southern Nigeria Survey.**

Plan of Town of Lagos. Compiled at the Cadastral Branch, Southern Nigeria Survey. Revised to August, 1911. Scale 1 : 3960 or 16 inches to 1 stat. mile. London: Edward Stanford, 1911.

Morocco. **Schnell.**

Zur Kartographie Nordmarokkos. Uebersichtskarte der Peilungen zu Blatt 1: Das Bergland westlich von Fas. Von Prof. Dr. Paul Schnell. Scale 1: 300,000 or 1 inch to 4·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1911, II., Tafel 42. Gotha: Justus Perthes, 1911. *Presented by the Publishers.*

Morocco. **Service Géographique de l'Armée, Paris.**

Carte du Maroc. Scale 1: 500,000 or 1 inch to 7·8 stat. miles. Sheets: 10, Oued Dra; 11, Oued Saoura. Paris: Service Géographique de l'Armée, 1911. *Price* 1 *fr. each sheet.*

Sahara. **Service Géographique de l'Armée, Paris.**

Carte du Sahara Algérien. Scale 1: 1,000,000 or 1 inch to 15·8 stat. miles. Sheet: In-Salah. Paris: Service Géographique de l'Armée. 1911. *Price* 1.40 *fr. each sheet.*

South Africa. **"South Africa."**

The Railway Map of South Africa. Scale 1: 4,750,000 or 1 inch to 74·9 stat. miles. Revised to date and published by authority at the Offices of "South Africa," Winchester House, London, 1912.

Tripoli. **Dardano.**

Nuovo Carta della Tripolitania e Cirenaica. Costruita e disegnata da A. Dardano. Scale 1: 5,000,000 or 1 inch to 78·9 stat. miles. Novara: Istituto Geografico de Agnostini, [1911]. *Price* 0.60*l.* *Presented by the Publishers.*

Tripoli. **Istituto Geografico Militare, Florence.**

Carta del Territorio della Tripolitania fra la costa ed il Gebel dal Confine Tunisino a Mesrata. Scale 1: 400,000 or 1 inch to 6·3 stat. miles. 2 sheets. *Price* 1.60*l.* Carta dimostrativa della Cirenaica. Scale 1: 600,000 or 1 inch to 9·5 stat. miles. *Price* 0.60*l.* Tripolitania. Zona littoranea da Zavia ad Argub. Scale 1: 50,000 or 1·3 inch to 1 stat. mile. *Price* 0.50*l.* Florence: Istituto Geografico Militare, 1911.

Maps of Tripoli and Cyraneica, with the hinterland, compiled for use during the present military operations in the country.

Tripoli. **Langhans.**

Der italienisch-türkische Kriegschauplatz in Tripolis. Das Operationsgebiet im nordwestlichen Tripolitanien um Tripolis, Homs (Lebda) und Mesrata bis an den Fuss des Djebel Nefusa. Scale 1: 750,000 or 1 inch to 11·8 stat. miles. Plan von Tripolis und seiner Oase mit d. Befestigungen, Kasernen u. Brunnen. Scale 1: 25,000 or 2·5 inches to 1 stat. mile. *Petermanns Mitteilungen*, Jahrgang 1911, II., Tafel 49. Gotha: Justus Perthes, 1911. *Presented by the Publishers.*

Wadai. **Millot, Moll, and Largeau.**

Croquis du Ouadaï Massalit. Dressé et dessiné d'après les principaux itinéraires de MM. Arnaud, Berraud, Bonjour, Brisset, Brulé, Chauvelot, Chaveyron, Crépin, Delacommune, Fiegenschuh, Georg, Hamel, Herrou, Hilaire, de Jonquières, Jourdy, Julien, Lucien, Maillard, Peignot, Ruaux, Sarles, Therat, Vasseur, sous le Commandement des Colonels Millot, Moll, Latgeau, Commt. le Territoire Militaire. Scale 1: 1,000,000 or 1 inch to 15·8 stat. miles. Paris: Augustin Challamel, 1911.

This sheet extends in latitude from 24° N. to 28°, and from longitude 17° E. to 22° E. It has been compiled from the route traverses and surveys of various French officers, and gives a considerable amount of information concerning caravan tracks, watercourses, wells, etc. A useful table of latitudes and longitudes, determined by astronomical observations, is given at the side of the sheet.

AMERICA AND WEST INDIES.

Brazil. **Commissão Geographica e Geologica do Estado de S. Paulo.**

Estado de S. Paulo. Scale 1: 100,000 or 1 inch to 1·6 stat. mile. Sheet: Franca. S. Paulo: Commissão Geographica e Geologica do Estado de S. Paulo, 1911. *Presented by the Commissão Geographica e Geologica do Estado de S. Paulo.*

Brazil. **Directoria da Viação da Secretaria das Obras Publicas Rio Grande.**

Carta das Lagôas dos Patos e Mirim mostrando a linha de navegação entre os portos interiores e a Barra do Rio Grande do Sul. Organisada na Directoria da Viação da Secretaria das Obras Publicas do Estado do Rio Grande do Sul. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Rio Grande : Directoria da Viação da Secretaria das Obras Publicas do Estado do Rio Grande do Sul, 1911.

Canada. **Department of the Interior, Ottawa.**

Railway map of the Dominion of Canada. Scale 1 : 2,217,600 or 1 inch to 35 stat. miles. 8 sheets. Ottawa : Department of the Interior, 1910. *Presented by the High Commissioner for Canada.*

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 64, Porcupine, revised to October 6, 1911 ; 68, Swift Current, revised to August 15, 1911 ; 73, Winnipeg, revised to September 29, 1911 ; 120, Qu'Appelle, revised to September 11, 1911 ; 172, Fairford, revised to March 15, 1911 ; 173, Washow, revised to September 12, 1911 ; 216, Sullivan Lake, revised to October 16, 1911. Ottawa : Department of the Interior, 1911. *Presented by the Department of the Interior, Ottawa.*

Chile. **Oficina de Mensura de Tierras.**

República de Chile. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheets : 47°–49° S. lat. ; 49°–51° S. lat. ; 51°–53° S. lat. ; 53°–55° S. lat. ; 55°–57° S. lat. Santiago : Oficina de Mensura de Tierras, 1910–1911. *Presented by the Director, Oficina de Mensura de Tierras, Santiago.*

These sheets complete the new Government map of Chile compiled from the latest surveys, including those of the Chile-Argentine Boundary Commission, and printed in colours. Each sheet covers an area of 2° of latitude and from 5° to 5½° of longitude, and measures 19 inches × 32 inches. All that part of the country south of 47° S. lat. is included in the present issue of the map. On the back of each sheet is an alphabetical list of the place-names, to serve as an index. There are also some useful statistical tables.

Trinidad. **Bacon.**

Map of the Island of Trinidad. Scale 1 : 89,100 or 1 inch to 1·4 stat. miles. Originally designed by Capt. Mallet, R.E. Revised and brought up to date from the latest available official and private surveys. 4 sheets. London : G. W. Bacon & Co., Ltd., 1912. *Price* £2 2*s*. *Presented by the Publishers.*

Notwithstanding the long time that has elapsed since Captain Mallet's map of Trinidad was first published about sixty years ago, very little has been done in the way of producing a general topographical map of the island. Maps of certain districts and road maps have been published, but as a general map of the whole island nothing has taken the place of that drawn by Captain Mallet. Using this as a basis, Messrs. Bacon has now revised the map from the best available material and brought it up to date as far as possible.

PACIFIC ISLANDS.

Samoa. **Wegener.**

Die deutsch Samoa-Insel Apolima. Aufgenommen von Dr. Kurt Wegener 1909. Uebersicht von Apolima. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Dorf und Lagune 1909. Scale 1 : 2500 or 25·3 inches to 1 stat. mile. *Petermanns Mitteilungen*, Jahrgang 1911, II., Tafel 44. Gotha : Justus Perthes, 1911. *Presented by the Publisher.*

GENERAL.

General. **Bacon.**

Bacon's Excelsior Maps. Ireland with the adjacent coast of Great Britain. Scale 1 : 760,000 or 1 inch to 12·1 stat. miles. *Price* 7*s*. 6*d*. Dominion of Canada. Scale 1 : 5,700,000 or 1 inch to 90 stat. miles. *Price* 7*s*. 6*d*. Australasia (Contour Edition). Equatorial Scale 1 : 5,700,000 or 1 inch to 90 stat. miles. 4 sheets. *Price* 16*s*. New Zealand (Contour Edition). Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. 4 sheets. *Price* 16*s*. London : G. W. Bacon & Co., Ltd., [1911]. *Presented by the Publishers.*

A set of boldly executed wall maps showing heights of land and depths of water on the tinted layer system. On some of the maps the colours are too heavily printed, and a better selection of tints might have been employed, especially for the lower land levels.

World. **Bacon.**

Bacon's Excelsior Contour-Relief Atlas. London: G. W. Bacon & Co., Ltd. [1911]. *Price* 1*s*. *Presented by the Publishers.*

A new edition of a cheap little general atlas containing a series of physical and meteorological maps, followed by a set of maps of the continents in pairs, one showing the relief on the usual layer system, and facing this another, on the same scale, showing it enormously exaggerated, as it would appear on a photograph of a raised model.

World. **Bacon.**

Bacon's New Series of Contour Hand Maps: South-East England and its connection with the Continent; Central Europe; North-West Europe; Basin of the Danube: Basin of the Rhone; Basin of the Hudson and junction with the St. Lawrence; Basin of the Thames; Basin of the Wey and Mole; Basin of the Great Ouse; Basin of the Lea; Basin of the Weaver and Mersey; Basin of the Bristol Avon; Basin of the Trent; Basin of the Severn; Lake District; Forth and Clyde Depression; Mediterranean and surrounding countries. London: G. W. Bacon & Co., [1911]. *Price* 1*d*. *each*. *Presented by the Publishers.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from December 3 to 31, 1911. *Presented by the Hydrographer, Admiralty.*

New Charts.—No. 1778, Borneo island: Ambong and Usukan bays, 3*s*. **New Editions**—No. 1267, England, south coast: Approaches to Plymouth, 3*s*. 3023, Ireland, north coast:—Lough Swilly: Buncrana and Rathmullan anchorages, 2*s*. 1447, Ireland, east coast: Dublin bar and the river Liffey to O'Connell bridge, 3*s*. 233, Africa, north coast: The Suez canal, 3*s*. 1766, Africa, north coast: Cape Ferrat to Cape Bougaroni (Plans: Mostaghanem Port Shershel, Arzeu, Port Tipaza, Dellys, Pisan rocks), 3*s*. 2027, Gulf of St. Lawrence, Prince Edward island: Cascumpeque harbour, 2*s*. 339, Nova Scotia, south coast: Baccaro point to Pubnico harbour, 3*s*. 2189, British Columbia: Ports adjacent to Principe and Grenville channels: Port Canaveral, Port Stephens, Klewnuggit inlet, Lowe inlet, Coghlan anchorage, 2*s*. 1860, Africa, west coast: Cape St. Paul to Porto Novo, 2*s*. 8*b*, Red sea: sheet 2 (Plans: The Brothers islands, Koseir anchorage, Sherm Wej, Sherm Hassey, Sherm Rábegh. Yenbo, Dædalus shoal, Scout anchorage), 3*s*. 8*c*, Red sea: sheet 3 (Plans: Khor Dhú-l-Lawá, Khor Shinab, Mersa Ar-Rakiyaí, Lith, Jelájil, Kunfida), 3*s*. 8*d*, Red sea: sheet 4 (Plans: Khor Nowarat, Khor, Nohud, Village bay, Gizán, Loheiya), 3*s*. 3599, Plans and anchorages in the Persian gulf: Henjam island anchorage. Plans added: Ras al Khaima, Magam, Linga, Dibai, 2*s*. 1601, China, north-east coast: Wusung river or Hwang pu, Wusung river entrance, 4*s*.

(*J. D. Potter, Agent.*)

America, North. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, January, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, December, 1911. Washington: U.S. Hydrographic Office, 1911. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Hydrographic Office.**

Determining distance from a wireless station equipped with sound signals. Supplement to the Pilot chart of the North Atlantic Ocean, 1911. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, January, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, January, 1912. London: Meteorological Office, 1912. *Price* 6*d*. *each*. *Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, January, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, February, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, January, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, February, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, January, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

China. **Teichman.**

Twenty-nine photographs taken during a journey made in August, 1911, through the Tibetan Tribal Country west of Chêng-tu, by Eric Teichman, Esq., B.A. *Presented by Eric Teichman, Esq., B.A.*

These are specially interesting from the fact that they are of the region explored by the late Mr. J. W. Brooke and Rev. W. N. Fergusson, whose surveys were recently published in the *Geographical Journal*. Mr. Teichman is connected with H.B.M. Consular Service in China, and has made good use of his opportunities while travelling in the region to take photographs.

(1-3) Bamboo rope suspension bridges across the Min river at Huan Hsien; (4 and 5) Gorges leading up to the Niu-tou-shan pass; (6 and 7) Gorges leading up to the Palan pass; (8) View looking south from Palan pass; (9) Village of Erh-lung-kuan; (10) Village of Ta-wei; (11) Lamasery of Ta-wei; (12) Castle of Orih chief, Orih-kuan-chai; (13) Lamasery of Mengkung; (14) Confluence of the two branches of the Small Gold river, near Meng-kung; (15) Gorge of the Small Gold river (Hsiao Chin Ho) near Fuepien; (16) Lamasery at Mu-po; (17) Interior of Mu-po lamasery; (18) Valley leading up to the Hung-Chiao pass; (19) South-western slope of Hung-Chiao pass; (20 and 21) Summit of Hung-Chiao pass; (22) North-eastern slope of Hung-Chiao pass; (23) Snow-peaks near Hung-Chiao pass; (24) Gorge of the Lifan river near Tsa-ku-lao; (25) Cantilever bridge over the Lifan river; (26) Central building of Tsa-ku-lao lamasery: (27) A corner of Tsa-ku-lao lamasery; (28) Village near Tsa-ku-lao; (29) Village near Lifan.

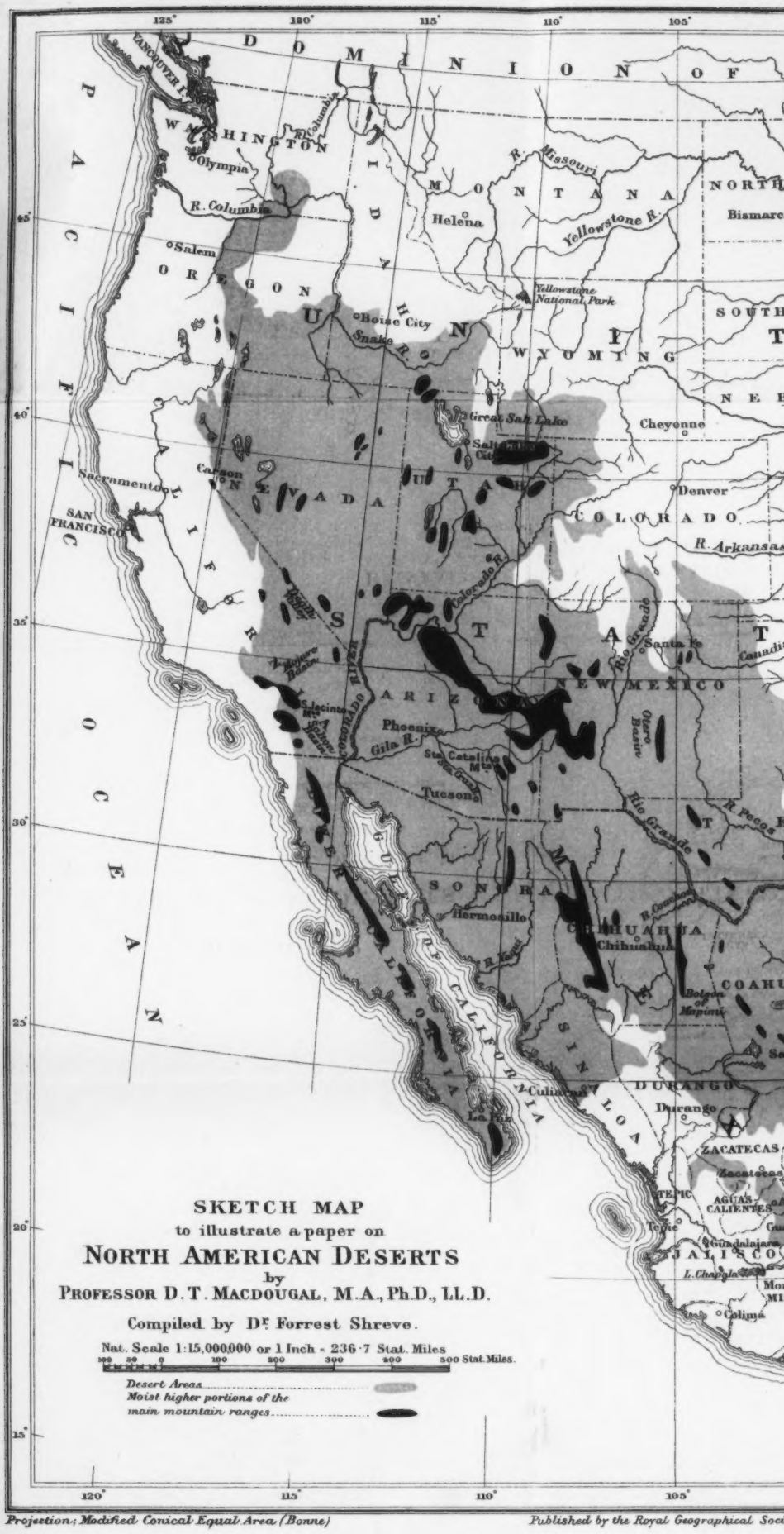
Gambia and Senegal. **Reeve.**

Twelve photographs of Gambia and Senegal, taken by the Hon. Henry Reeve, C.M.G. *Presented by the Hon. Henry Reeve, C.M.G.*

A set of excellent Kodak panoramic views measuring 3¾ inches by 12 inches. They are specially welcome to the Society's collection, as they are the first set of the Gambia that have been presented.

(1) East front, Bathurst; (2) Mangroves at Sea Horse island; (3) Wharf at Ballangar; (4) McCarthy island from up-river; (5 and 6) Fly point above Perai; (7) The native town of Charnum; (8) The assembly to meet the Governor at Koina; (9 and 10) Ironstone cliffs at Falotenda; (11) Entrance to harbour, Dakar; (12) Dakar from the sea.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



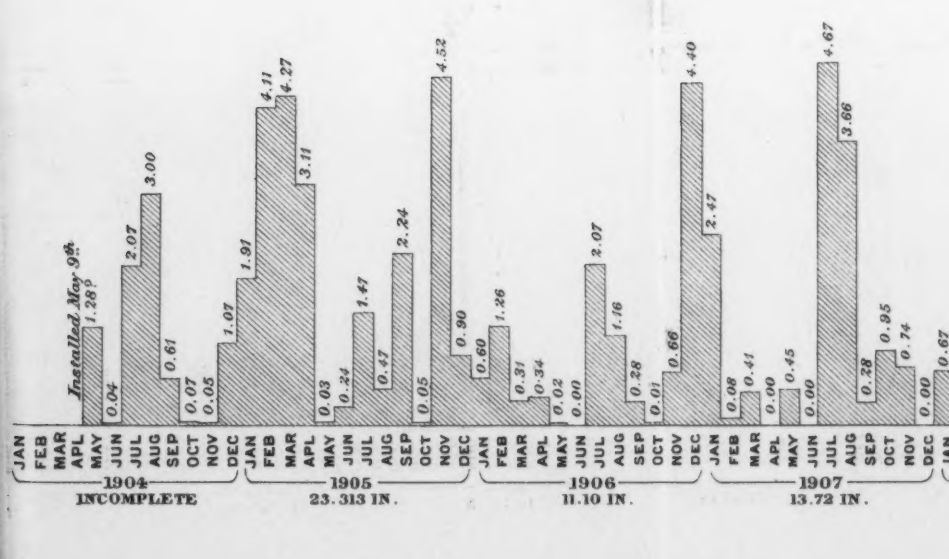
Projection: Modified Conical Equal Area (Bonne)

Published by the Royal Geographical Soc

RAINFALL AT THE DESERT LABORAT

TUCSON, ARIZONA, 1904-1910.

Compiled by Mr Godfrey Sykes.



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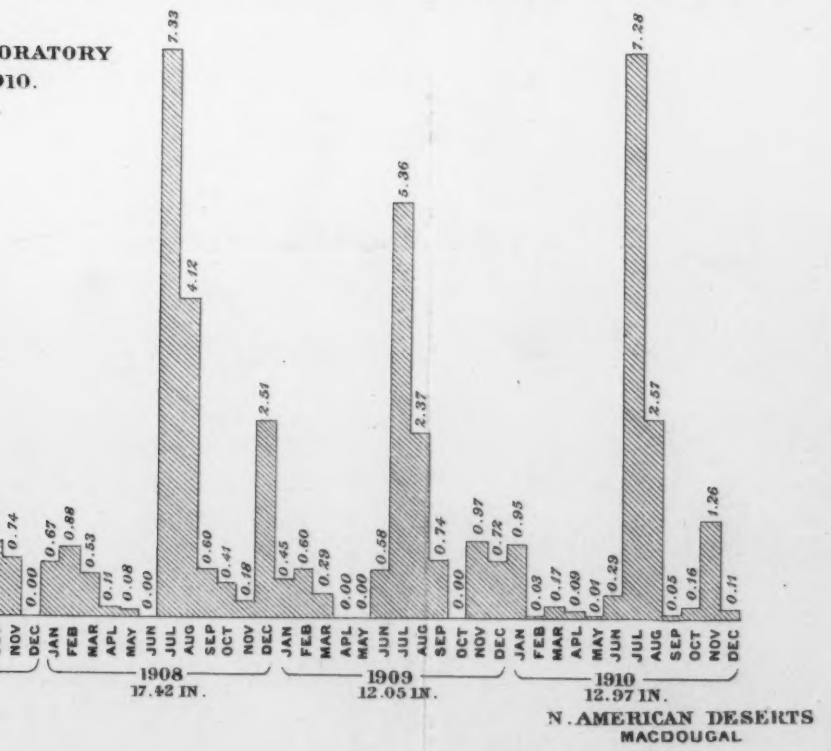


N. AMERICAN DESERTS
MACDOUGAL

NOTE.

This map is constructed from Mr. Harding King's prismatic compass route traverses, adjusted by latitudes and chronometric differences of longitudes from astronomical observations; and to positions laid down on the maps of the Egyptian Survey Department, from which also the topographical detail has been taken for the parts away for the routes followed. Distances on the routes were approximately obtained by time and rate of travel. On the first journey, in 1909, the astronomical observations were taken with a 4-inch transit theodolite, and on the second, 1911, with a 6-inch sextant and artificial horizon.

The chain of small depressions *in the north-east portion of the map depends upon two route traverses, made in 1909 and 1911, that of 1911 starting from a point fixed by the previous survey of 1909. The positions of Ain Um Debadib and Ain Amur on this portion of the map are taken from the maps of the Egyptian Survey. A star double altitude latitude was obtained on 4th Jan'r, 1911, and practically agreed with the positions as worked up by the traverse. The route from Camp 3 was closed on to Ain Amur, but the short routes from Ain Amur to the north-east, and north-east from the junction of the 1909 and 1911 routes are unchecked, while the large depression to the north of the latter was entirely unsurveyed.*

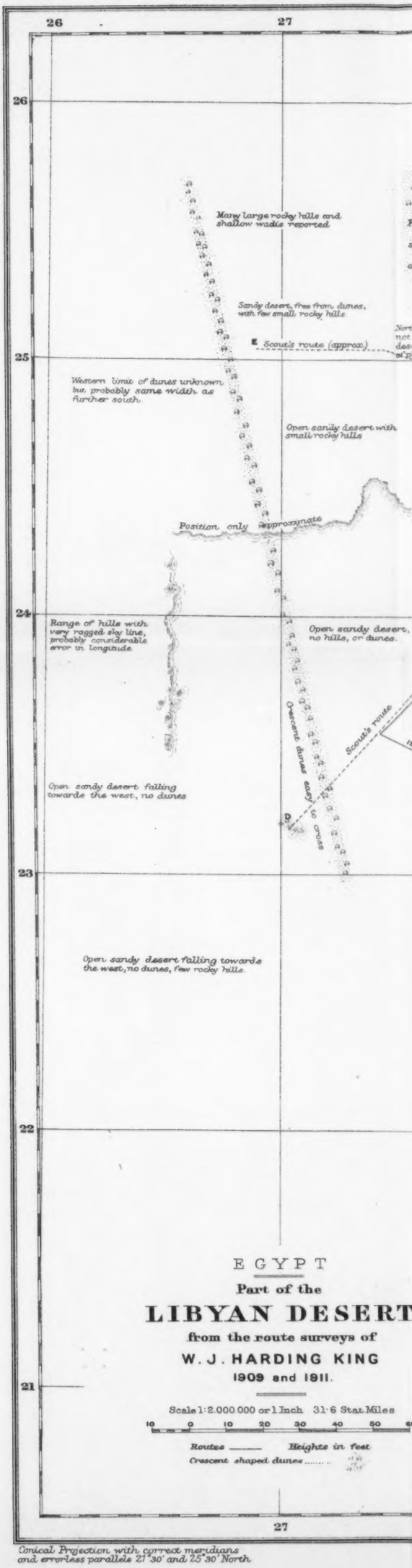
To the south-west of Dakhla *the map is dependent mainly on the route traverses of 1909 and 1911, checked by occasional astronomical observations. Mut was fixed by Mr. Beadnell while engaged on the survey of Dakhla for the Egyptian Government, and is taken from his large scale map of the oasis. The watch was rated by observations at Mut before the start and after the return from each journey in 1909, and was found to be going well. The two routes crossed at the point C, which provided means of checking the accuracy of the work. The agreement as regards longitude was very satisfactory, the difference being about 200 yards, which was remarkable, as no chronometric differences could be obtained on the 1911 route, owing to the watch having broken down; but the latitude of C obtained by observation in 1911 showed a considerable difference from that of the 1909 traverse, so that the latitude of the previous Camp No. 28 was worked out, and that of C deduced from it. The latitude of C finally accepted is a mean between that obtained by astronomical observation at Camp No. 28 and those worked up from the traverses.*

From Mut to Camp 24 (1909) the route was adjusted to the position of Mut, and from Camp 24 to Camp 25, by astronomical observations. From C to F the traverse was unchecked by astronomical observations but corrected to the small hill near F, as fixed by the 1909 route. The further of the two ranges of hills west from F was not surveyed, though the gap between the two ranges was fixed by bearings. The position of the hill at the extreme west of the further range depends upon a single bearing from F, and estimated distance.

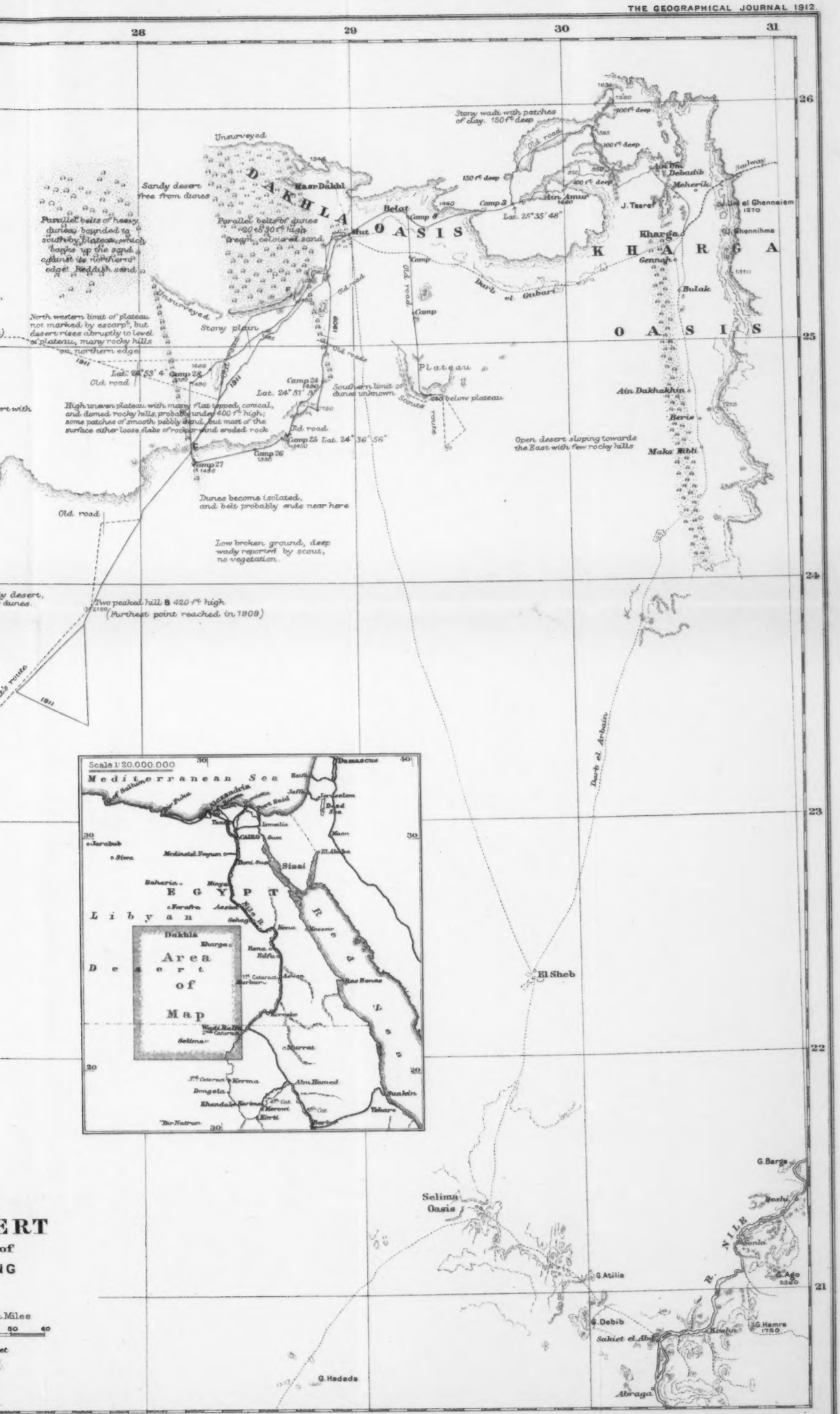
There is no means of estimating the accuracy of the north-west limit of the plateau, except where the route of a scout, who was sent forward, touched it, and fixes it roughly. This point is shown by E on the map.

South of C there were no astronomical observations, and the route is plotted directly from the compass traverse. The latitudes obtained from astronomical observations which have been accepted are given on the map itself. These are from altitudes of Polaris, and double altitudes of Sirius and Procyon.

The heights *along the routes are from aneroid readings, which have been computed by the Egyptian Survey Department, with the mean of the readings at Aswan, Assiut and Dakhla taken as a base, with correction to sea level. The results, though perhaps not greatly in error, can only be taken as approximate. Other heights given are from the Egyptian Survey maps.*


26
27
26
25
24
23
22
21
Many large rocky hills and shallow wadis reported.
Sandy desert, free from dunes, with few small rocky hills
E Scout's route (approx.)
Western limit of dunes unknown but probably same width as further south.
Open sandy desert with small rocky hills
Position only approximate
Range of hills with very ragged sky line, probably considerable error in longitude.
Open sandy desert, no hills, or dunes.
Crescent dunes easy to cross
Scout's route
D
Open sandy desert falling towards the west, no dunes
Open sandy desert falling towards the west, no dunes, few rocky hills
EGYPT
Part of the
LIBYAN DESERT
from the route surveys of
W. J. HARDING KING
1909 and 1911.
Scale 1:2.000 000 or 1 Inch 31·6 Stat. Miles
10 0 10 20 30 40 50
Routes _____ Heights in feet
Crescent shaped dunes .....
27

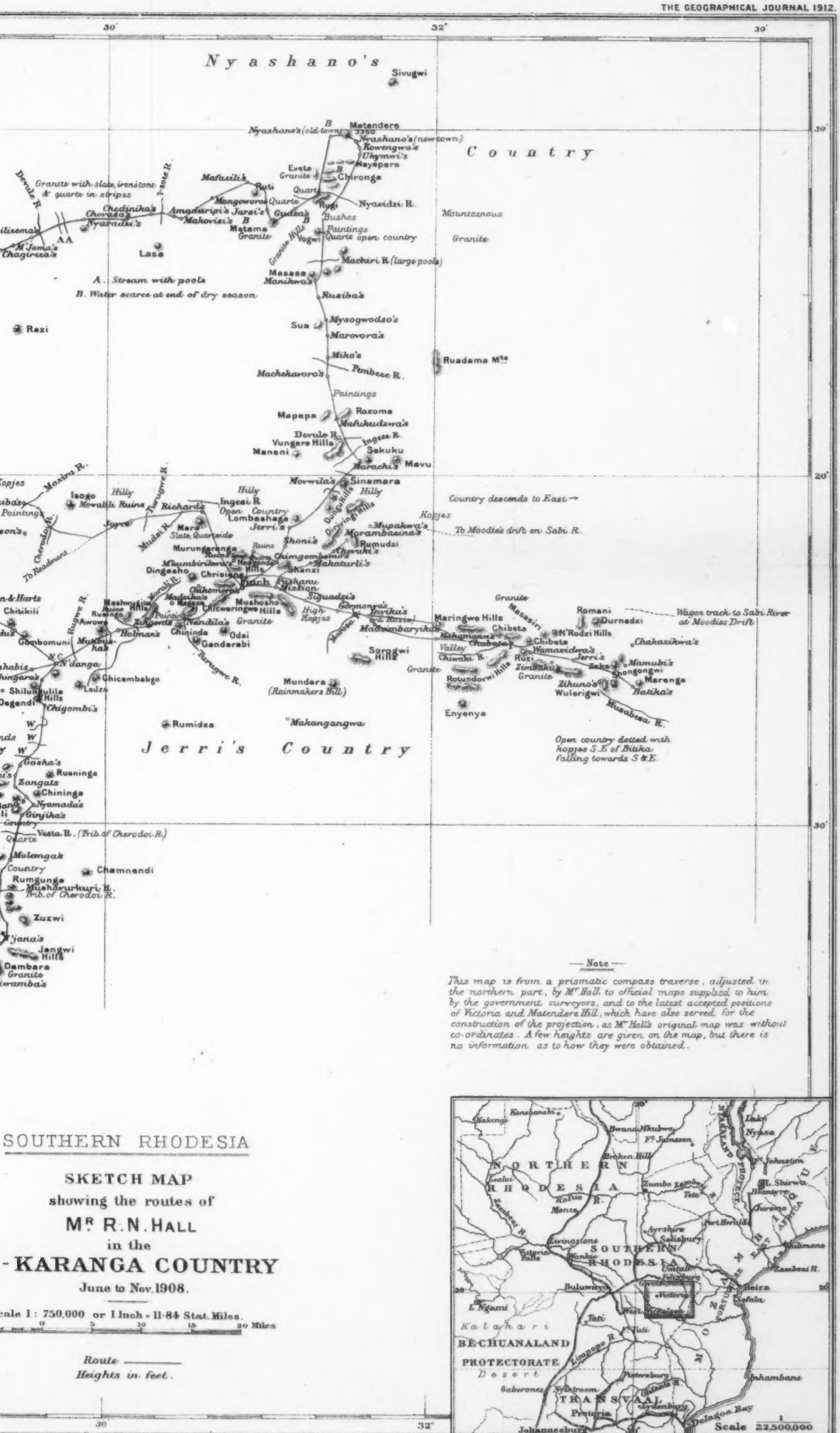
Conical Projection, with correct meridians and errorless parallels 21°30' and 25°30' North.



Published by the Royal Geographical Society

LIBYAN DESERT
King.

30'
31°
20'
21°
Zimutu's Country
Chibi's Country
Nini Country
Chikanga's Country
Shangaans
VICTORIA
Rothman
Rutherford
Muchakati
Nyaguswe 3090 ft.
Mashaba
Mine
Inyanda
Tjwaiti's
Rivuri
Cheringaringa's
Chibi's (Old Town)
Mashandilli's
Matendi's
Masovozi's
Zibi's
Nyaningwe Hills
Maguendi's
Maroni's
Mafure
Nyadire R.
Gungwe
Tishaba
Kolioto
Mora's
Danga
Granite
Mosogwi's
Chilogwi
Chivali
Two Conical Hills
Old Telegraph line
Rungyi (Double Peaks)
Rumpki's
Livamugisi
Chapeta's
Dendi R.
Chosi
Titzoka's
Matedzi R.
Mapandi
Dendi R.
Chamata's
Dovovugwe
Tidi
Manyanka
Bongenwi
Quereda's
Chilongwi
Bongodowi Range
Shindi's Kopjes
Dummgulu
Misenda
Dendera's
Mashagwa
Manyngara
Tatarikwa's
Shindi
Chiridza
Mafanderabiga's
Mashakati's
Mangukui's
Yumbi
Mara
Rundi R.
Zingyembakakoro's
Drift
Rusitungu R.
Mazidzi
Schitzka's
N.C.'s Temporary Camp Sept. 1903.
Rundi R.
River pools with Hippopotami
Nyuni Hills
Matumaneshaba
Baramuimba's
Zimbabwe
Berome Hills
Mogabi
Morgenster 3340
Ragutsi's
Mashikema's
Rundee
Zinderi's
Rushumbi
Makosi R.
Zaridas
Mutumba
Gondovi
Vinvi (Shumba's Hill)
Diryo
Kuerimba's Kopjes
Masininieye
Mokwevwa's
Mouseiri's
Makosi R.
Wombigi
Kusahuidi Conical
Granite kopjes
Villages some distance from path
Lands & Vleys
Makumini's
Birambila
Quangobye R.
Zingeri's
Chigurya's
Madzuynyka's
Ravengwi
Mushakata
Bongomabgi
Movengele's
Savi R.
Tegue R.
Chidapi
Shoshama
Mashikanu
Mufuonori's
Granite
Ivuma
Matakanas
Jafra's
Bavuvonde
Tower hill
Slate, Ironstone
Granite
Huzuwa's (Karanga)
Zingyembakakoro's Kopjes
Granite
Slate & Ironstone
Granite Hills
Granite
Granite
Hilly
Village
Hilly
Village
Quartz
Granite
Granite
Granite


30'
32'
30'
Nyashano's Country
Sivugwi
Matendere
Nyashano's (old town)
3350
Nyashano's (new town)
Kowengwa's
Ukymwi's
Nayepara
Chironga
Granite with slate ironstone & quartz in stripes
Mafuzili's
Ruti
Quartz
Nyasidzi R.
Mangoworo
Quartz
Chedinika's
Amadaripi's
Jarst's
Gudza's
Bushes
Mountainous
Chewasa's
Nyaradzi's
Makovisi's
Matema
Granite
Paintings
Quartz
Yogwi
open country
Granite
Lasa
Machiri R. (large pools)
Granite Hills
Masasa
Manikwa's
A. Stream with pools
B. Water scarce at end of dry season
Rusiba's
Razi
Sua
Mysogwodzo's
Marovora's
Miko's
Ruadama Mts
Pembere R.
Machekavoro's
Paintings
Mapepa
Rozoma
Mafukudzwa's
Devule R.
Vungere Hills
Ingesi R.
Maneni
Sekuku
Marachi's
Mavu
Sinamara
Morwida's
Hilly
Hilly
Country descends to East →
Kopjes
Mupakwa's
To Moodie's drift on Sabi R.
Morambawina's
Rumudzi
Richards
Ingesi R.
Open Country
Lombasheza
Jerri's
Mara
Slate Quartzite
Shoni's
Murungarenga
Ruins
Chimgombwima
Makaturli's
Mambirikwa's
Hills
Dingasho
Chrisiana
Skanzi
Inch
Mission
Chikamoyo
Siguadzi's
Gormonga's
Invika's
Old Kopjes
Madzimbabvyrikwa
Granite
Massiri
Romani
Durnedzi
Wagon track to Sabi River at Moodies Drift
Maringwe Hills
Chibeta
N'Rodzi Hills
Chakazikwa's
Chibeta
Wamasvidera's Jerri's
Valley
Chiwaki R.
Ruzi
Zake
Mamubi's
Shongongwi
Maranga
Hatika's
Zihuno's
Wulerigwi
Musabesa R.
Granite
Rotundorwi Hills
Zimbaku's
Granite
Enyenya
Mundara
(Rainmakers Hill)
Rumidza
Makangangwa
Jerri's Country
Open country dotted with kopjes S.E. of Bitika falling towards S & E.
Isago
Hilly
Mowalli Ruins
Richards
Ingesi R.
Open Country
Lombasheza
Jerri's
Mara
Slate Quartzite
Murungarenga
Ruins
Shoni's
Chimgombwima
Makaturli's
Mambirikwa's
Hills
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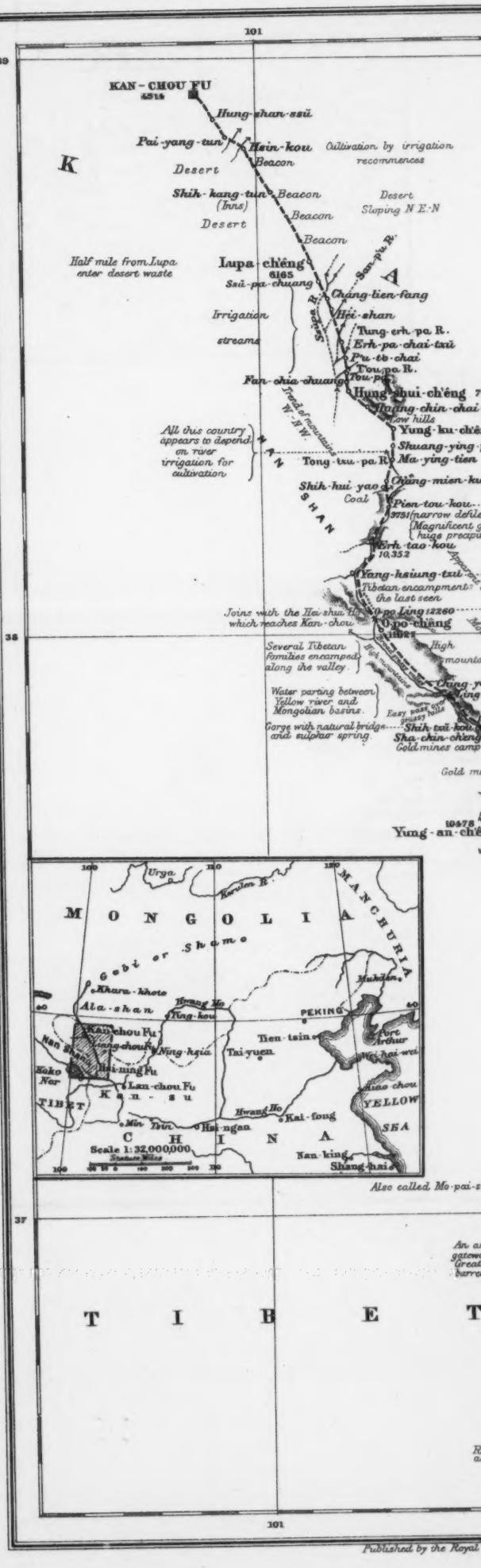
(Rainmakers Hill)
Rumidza
Makangangwa
Jerri's Country
Open country dotted with kopjes S.E. of Bitika falling towards S & E.
Kopjes
Morava R


101
39
KAN-CHOU FU
4514
Hung-shan-ssŭ
Pai-yang-tun
Hsin-kou
Beacon
Cultivation by irrigation recommences
K
Desert
Shih-kang-tun
(Inns)
Beacon
Desert
Sloping N.E.-N
Beacon
Beacon
Half mile from Lupa enter desert waste
Lupa-ch'êng
6165
San-pa R.
A
Ssŭ-pa-chuang
Chang-tien-fang
Irrigation streams
Hei-shan
Tung-erh-pa R.
Erh-pa-chai-tzŭ
Pu-to-chai
Tou-pa R.
Fan-chia-chuang
Tou-pa
Hung-shui-ch'êng
Trail of mountains N.W.-N.W.
All this country appears to depend on river irrigation for cultivation
Low hills
Yung-ku-ch'ê
Shuang-ying
Tong-tzu-pa R.
Ma-ying-tien
Shih-hui-yao
Coal
Pien-tou-kou
9751 (narrow defile
Erh-tao-kou
10,352
Yang-hsiung-tzŭ
Tibetan encampment
Joins with the Hei-shui R. which reaches Kan-chou
O-po Ling 12260
O-po-chang
38
Several Tibetan families encamped along the valley
Water parting between Yellow river and Mongolian basins
Gorge with natural bridge and sulphur spring
Shih-tzŭ-kou
Sha-chin-ch'êng
Gold mines camp
Gold mi
19478
Yung-an-ch'ê
MONGOLIA
MANCHURIA
Urga
Karulun R.
Gobi or Shamo
Khara-khoto
Ala-shan
Hwang Ho
Kung-kou
Muhden
PEKING
Kan-chou Fu
Liang-chou
Ning-hsia
Tai-yuen
Tien-tsin
Port Arthur
Wei-hai-wei
Nan Shan
Koko Nor
Hsi-ning Fu
Lan-chou Fu
K a n - s u
TIBET
Hwang Ho
Kai-fong
Min
Tsin
Hsi-ngan
YELLOW SEA
C H I N A
Nan-king
Shang-hai
Scale 1:32,000,000
Also called Mo-pai-s
37
T I B E T
101
Published by the Royal

CHINA

Compass Route Traverse between HSI-NING FU AND KAN-CHOU FU by O. R. COALES.

August & September 1910.

Scale 1:1000000 or 1 Inch 15·78 Stat Miles.

20 10 0 10 20 Miles

Route — — — — —

Note No Astronomical observations were taken by Mr Coales and his compass traverse has been adjusted to the position of Kan-chou and Hsi-ning Fu, the former as given by Dr M.A. Stein, and the latter as laid down on Col. P.K. Kozloff's map, published in the Geographical Journal September 1910 and the new French Government Map of Asia, Scale 1:1000000. This adjustment has made it necessary to reduce the distance between these two points as roughly estimated by Mr Coales from rate of travel by about 12 per cent; the excess being doubtless due to the rugged nature of the region traversed. The heights are in feet from boiling point and aneroid readings, and are referred to Hsi-ning Fu, which is taken as 7506 feet above sea level.

N

102

39

38

37

Liken barrier and gateway, two hovels and shrine. Nobody allowed to pass to the south without certificate.

Below, this the valley becomes restricted to a gorge very tortuous.

An easy pass between two narrow but grassy valleys. Mountains of moderate height.

Kou-men-tzu (narrow pass)

Open, grassy country

Mow Pass

Camp 10708

Pei-shui-ho (Solitary Inn)

Grassy slopes

Tibetan camp

Hei-shih-t'ou 9688 no houses

Broad grassy slopes

Mongol camp. Prince Milo

Pai-tai-t'ung 9394

Flows in several branches.

Tou-t'ang 9225 Scattered houses and sparse cultivation.

Nan-mên Ruined gateway, no houses

Very steep and rocky

Shang-ta-pan Pass

General trend of mountains W-E.

Road very steep and rocky

All these places consist of two or three houses with little cultivation.

Above this the mountains close in and valley becomes deep and narrow.

Loess clad mountains cease about here.

Ta-t'ung Hsien

Numerous villages on left bank.

Road to Pietsitung via Kumon monastery and Hsia-ta-pan pass.

Fine gorge

Laoyeh Shan High rocky peak

Temples

An ancient wall and gateway said to be part of Great wall. Valley is here barred by a ridge

Loess mountains rising from near river to 1000 ft approx. very barren.

Barren Loess mountains

Cultivated fields

Ferry (bridge broken)

Hsi-ning R.

HSI-NING FU

Road to Pingan and Lake Koko Nor

Nan Chuan

Road to Kumbum

Mountains appear to come down to river

General trend JW-S-E

Crest 1-2000 ft above pass

Cliff & Bridge

Shang-ta-pan

Hei-lung R.

Ta-t'ung R.

Chang-yang

Erh-tao-kou

Gold mines

Pei Ho

Mo-pai-shêng

Wu-chia-pien-tzu

San-ch'êng-tzu

San-tang

Tu-chia-ai

Wu-chien-fang

Chuang-chia-t'an

Shih-lu-t'ou 8652

Hsia-mên-ch'iao

Hsiao-nieh-pa

Ta-nieh-pa

Shang-t'an-chuang

Hsia-t'an-chuang

Ch'i-erh-kou

Ta-mei-t'ung

Nan-mên-t'ung

Hsin-ch'êng

Ku-ch'êng

Huang-chia-chai

Ch'ang-ning-pu

Hou-tzu-ho

Hsia-sung-chia-chai

Hsiao-chai

Erh-shih-li-tun

Shih-t'ou-ho

T'ao-chia-t'un

Shih-li-p'u

Chih-fang (Bridge)

Hsi-ning R.

S

T

U

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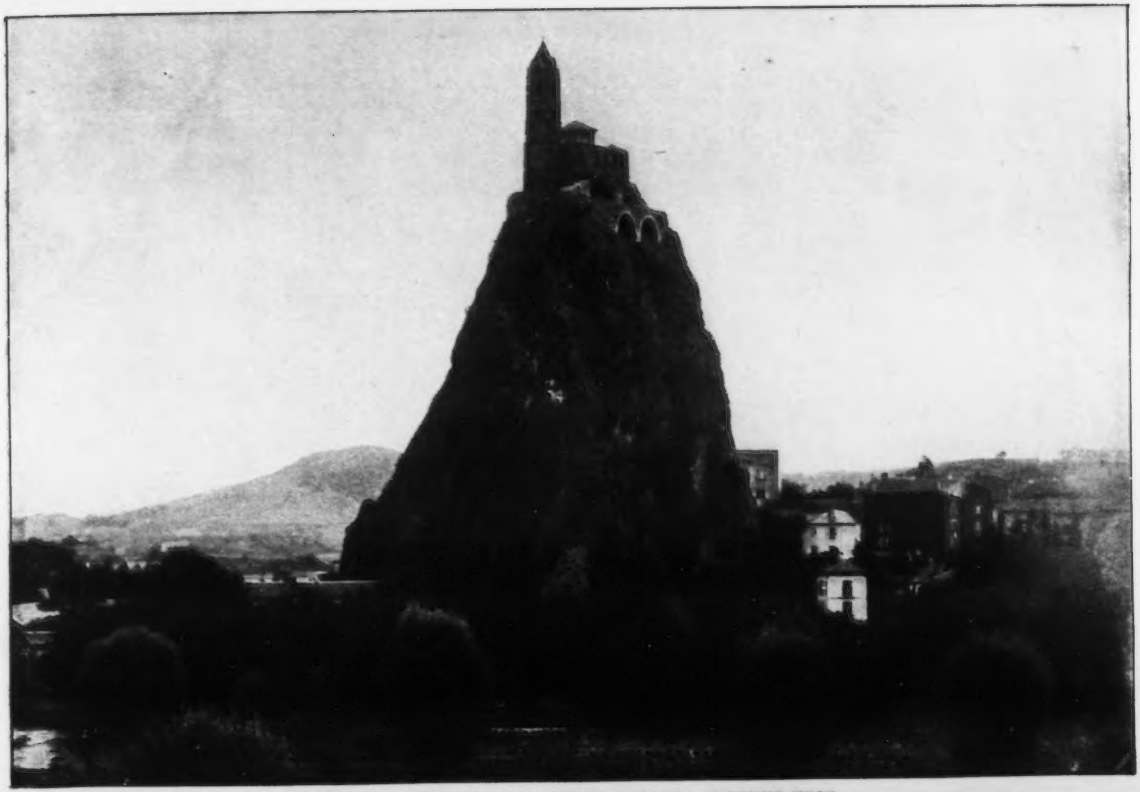

ROCHER ST. MICHEL, LE PUY, CENTRAL FRANCE. VOLCANIC NECK.

(*From Tempest Anderson's 'Volcanic Studies.' Murray.*)

To replace plate of above title in Dr. Anderson's lecture in *Geographical Journal* of February, which ought to be labelled

LAVA FLOW, COLUMNAR BASALT, JAUJAC ARDÈCHE.

To replace plate of above title in Dr. Anderson's lecture in *Geographical Journal* of February, which ought to be bleached

LAVA FLOW, COLUMNAR BASALT, JAUJAC ARDÈCHE.